





















THE  
LEPIDOPTERA  
OF THE  
BRITISH ISLANDS  
*VOL. VII.*





THE  
LEPIDOPTERA  
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BRITISH ISLANDS

*A DESCRIPTIVE ACCOUNT OF THE FAMILIES, GENERA, AND  
SPECIES INDIGENOUS TO GREAT BRITAIN AND  
IRELAND, THEIR PREPARATORY STATES,  
HABITS, AND LOCALITIES*

BY  
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HETEROCERA  
GEOMETRINA

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# LEPIDOPTERA.

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## DIVISION 2. HETEROCERA.

### Group 4. *GEOMETRINA*.

#### Family 1. **BOARMIDÆ**.

##### Genus 10. **PANAGRA**.

ANTENNÆ simple; palpi minute; head and thorax rather rough, the latter narrow; abdomen long and very slender; fore wings broad, but elongated and pointed; hind wings large and rounded behind.

We have but one species.

1. **P. petraria**, *Hüb.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{8}$  inch. Fore wings broad, pointed, pale reddish-brown, dusted with darker; the two transverse lines brown, oblique, parallel, the second edged with white; discal spot a black dot. Hind wings large, white with a partial transverse brown bar. Abdomen long and slender.

Antennæ of the male simple, very minutely ciliated, pale purple-brown; palpi very small, and, with the head, dull purplish-grey; thorax rather rough from raised ends of the otherwise smooth scales, purplish-drab; abdomen very smooth,



long, slender and tapering, paler purplish-drab; lateral and anal tufts small but distinct, of the same colour. Fore wings broad yet pointed; costa arched at the base and thence nearly straight to the apex, which is sharply angulated; hind margin faintly retuse, then full and gently curved off, but the anal angle well marked; dorsal margin almost straight; general colour pale reddish-brown or reddish-drab; first line red-brown, very slender, oblique and slightly curved; second line very oblique, straight, strongly marked, red-brown shaded off a little inwards, outwardly bordered with white; beyond this is a faint, slender, rather waved subterminal line of the same reddish-brown; discal spot a round purple-brown dot; cilia glossy pale purplish-grey. Hind wings very ample, rounded behind, but the apical and anal angles rather full; silky-white, faintly tinged over the hinder area with purple; from the dorsal margin arises a partial, straight, cloudy brown transverse stripe which usually fades out before it reaches the middle of the wing; cilia pale purplish-grey. Female extremely similar.

Underside of the fore wings pale purple-brown, tinged in the middle with smoke-colour, and beyond faintly barred with the same, shading off to shining white along the dorsal margin; discal spot smoky-black. Hind wings pale purple dusted with brown; the nervures tinged with red-brown; central spot smoky-black, obscure and very small; towards the hind margin is a series of smoky-brown dots on the nervures; cilia all purplish-white, shaded with smoky dashes. Body and legs purplish-white or pale purple-brown.

Hardly variable except a little in the distinctness of the markings, and especially in the intensity of the colour of the straight second line; but a specimen which I took in Ranworth Fen is of a very pale straw-colour with the markings excessively faint. This is the only variety in this species, of any note, which has come under my observation.

On the wing in May and June, but occasionally, in the South, at the end of April.

LARVA rather over an inch long, cylindrical, and of uniform size throughout, except that the segmental folds look contracted and the head is rather flattened. Ground colour olive-green, sometimes with a slight reddish tint; at first sight the whole larva seems to be covered with very slender chocolate-brown longitudinal lines—I could count at least twenty-four all round the body, but on examination it is seen that these are arranged in pairs; thus there is a double dorsal and three double subdorsal lines, the lowest being the darkest and thickest; spiracles black; below them is a creamy-white line; undersurface olive-grey; striped somewhat as the back, but the lines are more diffuse and not so numerous; segmental folds red.

End of May, and June, on the common brake-fern (*Pteris aquilina*). It assimilates well with its food plant, resting upon it at full length, and must be hard to detect. When disturbed will twist into knots and jump about most angrily. (Rev. J. Hellins.) Although so common, this larva seems very seldom to be noticed.

PUPA apparently undescribed—in the earth. The winter is passed in this condition.

The moth hides during the day among brake-fern, especially in open woods and on heaths and commons, and is easily disturbed from the last year's dead fronds, flying to a short distance to settle again in a similar situation. At dusk it flies of its own accord, and later at night may readily be picked off the dead fern or neighbouring grass stems. Not found in all places in which the brake-fern grows, but in suitable localities, as above described, apparently occurring throughout England and Wales, and in many parts abundant. In Scotland found in Clydesdale and the Western districts immediately north of the Solway Firth, also rarely around Edinburgh. In Perthshire, Sir Thomas Moncrieffe noticed its sudden appearance on Moncrieffe Hill in 1871, in a single patch of bracken (brake-fern). He had not seen it

before in the district, but it afterwards spread all over the hill. There is also a record in Argyleshire. In Ireland it is locally abundant in Wicklow, Waterford, Cork, Kerry, Galway, Limerick, Roscommon and Kings County. Abroad it has a wide range through Central Europe, Eastern Spain, Central and Northern Italy, Corsica, Livonia, Southern and Eastern Russia, Armenia, Tartary, China, and Japan, where it is very abundant.

#### Genus 11. **STRENIA.**

Antennæ simple ; palpi minute ; head rough ; thorax also rather rough and slender ; abdomen slender and short ; fore wings thin and rather narrow, chequered ; hind wings somewhat elongated, faintly angulated, and with the hind margin, within the cilia, scalloped.

We have but one species.

1. **S. clathrata**, *L.*—Expanse  $\frac{3}{4}$  to  $1\frac{1}{4}$  inch. All the wings pale yellow or yellowish-white ; nervures black ; four irregular brown-black or black stripes across the fore wings, and three across the hind, produce a complete latticed pattern ; cilia chequered, black-brown and white.

Antennæ of the male simple and rather small, ciliated, black, dotted at the back with yellow ; palpi very small, dark brown ; face smooth. upper part of the head rough, separated beneath the antennæ by a transverse channel, mottled, yellow and black ; a ridge on the neck, and also the collar, black in front, mottled with yellow at the back ; thorax roughened by the loose tips of the scales of the shoulder-lappets, yellow dotted with black ; abdomen short, smooth, yellow abundantly dotted with black, except at the edges of the segments ; lateral tufts distinct, yellowish-white ; anal tuft small. Fore wings blunt, narrow at the base ; costa gently arched ; apex bluntly angulated ; hind margin gently curved ; dorsal margin straight ; colour pale yellow or yellow-white ; all the nervures sharply purplish-



black or brown-black; hind margin dusted with the same, and the whole surface broken up, by four somewhat equidistant, transverse stripes of the same colour, into a reticulated or sieve-like pattern (hence the name); extreme hind margin edged with a sharp line of the same dark colour, with which also the white cilia are regularly chequered. Hind wings rather elongated, slightly angulated at the apex, and very obtusely so in the middle of the hind margin; in colour and markings accurately similar to the fore wings, except that the transverse stripes are three in number only; extreme hind margin edged by a faintly scalloped purple-black line, similar bars from the nervures chequering the white cilia. Female smaller, often considerably so, the ground colour sometimes paler, and markings darker. otherwise similar.

Underside an accurate repetition of the colouring and markings of the upper, except that the markings are of a more yellow-brown colour. Body and legs pale yellow, dusted with purple-brown.

There is considerable variation in this species in ground colour, from pale yellow to dusky yellow or to silvery white, this last being more particularly an Irish form; also in the form and position of the transverse stripes; the first and second sometimes being united, partially or wholly, and the third and fourth in a similar manner; or the fourth broadened into a considerable irregular band; or otherwise diminished and broken. A specimen in my own collection has the first, second and third stripes massed together into a very broad but hardly perfect band. One in Mr. Sydney Webb's cabinet has only a strong central stripe, the others being broken into detached transverse spots. Another of the same character has the stripe near the base; a third has but two slender stripes, one near the base, the other just before the hind margin. In Mr. S. J. Capper's collection is one having on fore and hind wings two broad bands each, and another having three very slender stripes on the fore wings and one on the hind, another being partially represented by spots, the

rest obsolete. In that of Mr. S. Stevens is an example in which the outer half of all the wings is devoid of transverse stripes. Specimens exist in several collections in which both fore and hind wings are entirely blackened except a few yellow or white spots, which usually are placed in a row before the hind margins, even the cilia being blackened; others occur in which this is partially the case, the whole surface being dusted with grey or clouded with black. One specimen in the collection of Dr. P. B. Mason, of a large size, is shining grey-black and not latticed, but has several, irregularly placed, large white spots. Mr. H. J. Turner possesses a very beautiful specimen, yellow, with the nervures dusted, but only partially blackened, the transverse stripes as usual, but the cilia of all the wings creamy-yellow without a trace of the usual black chequers. I have noted the extreme forms; intermediate varieties are numerous.

On the wing from the end of April till June, and as a partial second generation at the end of July and through August.

LARVA. Head shining green, rather hairy, with the lobes globular, and rather notched on the crown, mandibles brown; body cylindrical, of nearly uniform width throughout; skin smooth, clothed with a few, almost imperceptible, very short hairs; segmental divisions distinct; colour bright green, darkest along the sides; two parallel white lines extend through the middle of the dorsal area, enclosing between them an almost hair-like, white dorsal line; subdorsal lines white, as also are the broad spiracular lines, and there is another, finer, white line between the dorsal and subdorsal; segmental divisions yellowish; the spiracles very minute, black; ventral surface green, longitudinally striped with numerous very fine darker lines. When newly emerged from the egg dingy green, the extremities tipped with yellow; head pale brown. (G. T. Porritt.)

June and July, and a partial second generation in August

and September, especially on the common white Dutch clover (*Trifolium arvense*), also on some of the other clovers, lucerne, sainfoin, and medick.

PUPA three-eighths of an inch long, rather stout but tapering sharply towards the anal segment, which finishes with a fine point; the eye-, leg- and wing-cases prominent; colour dark mahogany-brown. In this stage through the winter, a portion of those from larvæ which feed up in July remaining through the winter with those of the partial later generation.

The moth flies in a lively manner by day in clover fields, and meadows in which clover exists, and is rather partial to chalk hills and the sheltered valleys between them. It flits about and settles on the plants with its wings alertly erect, and is a very pretty object. Tolerably common in such situations in the South of England to Middlesex, Bucks, and Gloucestershire, also in the Eastern Counties to Norfolk, but I have no record from Cornwall. Apparently very rare in the Midlands, but recorded in Staffordshire, and once in Derbyshire. Very local in Cheshire, Lancashire, Yorkshire, Durham and Cumberland. Probably in suitable spots throughout Wales, since it is recorded from the North of that country, and I have found it in Pembrokeshire. In Scotland its range is extremely limited, it has been found on railway banks in Berwickshire, and occasionally elsewhere in the districts of Tweed and Solway. In Ireland rather local yet very widely distributed, extending northward at least to Belfast. Abroad it is found almost all over Europe except a part of Spain; also in Asia Minor, Armenia, Bithynia, Tartary, the regions of the Altai range of mountains, and Japan.

#### Genus 12. **FIDONIA.**

Antennæ of the male pectinated; palpi small; head and thorax rough or even shaggy, the latter narrow; abdomen



slender, smooth ; fore wings blunt, trigonate, narrow at the base ; hind wings rounded ; underside richly coloured, and in the hind wings often handsomely marbled.

LARVÆ cylindrical, not stout nor attenuated ; without conspicuous prominences.

PUPÆ in the earth.

We have five species—readily distinguished.

A. Sexes diverse.

B. Male brown, female white, both with oblique black or brown bands. *F. atomaria.*

B<sup>2</sup>. Male black-brown with large white or yellow patches, female orange-brown. *F. piniaria.*

A<sup>2</sup>. Sexes similar.

C. Ground colour greyish-white with perpendicular black bands. *F. carbonaria.*

C<sup>2</sup>. Colour bright tawny with obscure red-brown bands. *F. pinctaria.*

C<sup>3</sup>. Rich orange, dotted and bordered with black. *F. conspicuaria.*

1. **F. atomaria**, L.—Expanse male 1 to 1½ inch, female  $\frac{7}{8}$  to 1 inch. Male pale ochreous, more or less abundantly dusted with brown, and having on the fore wings three or four irregular oblique cloudy-brown transverse stripes ; female white with the dusting and stripes black or brown-black ; cilia chequered.

Antennæ of the male pectinated almost to the tips with solid oblique ciliated teeth, black-brown ; palpi small but densely covered with rather long scales ; head rough, yellow-brown ; thorax rough from raised scales and, with the abdomen, black dusted with yellow ; lateral and anal tufts small. Fore wings somewhat trigonate ; costa hardly arched except a little at the base and apex ; the latter bluntly angulated ; hind margin oblique and regularly curved ; dorsal margin straight ; colour dusky-ochreous dusted abundantly

with brown ; four successive oblique cloudy-brown or black-brown transverse stripes occupy most part of the surface, the first curved, the second and third often partially united ; hind margin broadly of the same colour forming a fifth and broader stripe ; between these last stripes is usually a pale yellow or whitish spot opposite the middle of the hind margin ; cilia white chequered with brown. Hind wings rather elongated, rounded behind ; ochreous, dusted all over with brown ; central spot dark brown, before it is a transverse brown stripe and beyond it two more, besides a broader one along the hind margin, this last being usually broken into large spots, each of which throws out a brown dash upon the otherwise dull yellow cilia. Female very different ; antennæ simple ; body short ; fore wings narrower ; hind wings shorter and having their hind margin flattened so that the apical and anal angles are more decided ; colour white dusted with black. the stripes on the fore and hind wings placed as in the male but narrower, sharper and more definite, black or brown-black ; cilia all chequered, black and white.

Underside of all the wings of the male bright ochreous, slightly dusted with brown, the stripes of the upper side scantily and brokenly indicated ; cilia chequered, yellow and black-brown ; of the female white with the dark markings of the upper side accurately reproduced.

Variation in this species is great, and in the female very irregular. Males range from quite a yellow-brown, from paucity of the brown dusting, to those which are almost black-brown from its intensity, and beyond this to a smooth even dull black without speckling ; its bands are less variable, yet the second and third on the fore wings are often united from the dorsal margin to the middle, and the fourth and marginal bands frequently coalesce. A specimen exhibited by Mr. Goldthwaite at a meeting of the Entomological Society of London in 1886 was of a bright orange colour, with black blotches but no transverse stripes ; two in Mr. Sydney Webb's collection are pale ochreous with the stripes very

faint; another, of an orange-brown, has the markings absent except at the outer margins, yet is dusted with brown; a third has the dark stripes of enormous breadth; but his most astonishing specimen is wholly smooth pale ochreous-buff without a trace of markings. On the other hand a beautiful specimen taken in the County Wicklow, Ireland, by the Rev. J. Bristowe is quite unicolorous dark brown; Mr. Robt. Adkin has a male, taken in Surrey, wholly smooth smoky black-brown, except that the cilia are spotted with paler; Dr. P. B. Mason has one something similar, but its costal region is deeper black, and one whitish dot only is visible on the fore wings; specimens approaching to this degree of darkness seem not to be very rare on Cannock Chase and some other exposed heaths. One in the collection of Mr. Percy Bright is very curious, its right hind wing is of this smooth smoky-black, but the rest are quite normal. Another very singular form of this sex is in the collection of Mr. F. N. Pierce, its wings being as narrow as those of a female, and tinged with the same blacker colour. And Mr. Webb possesses a gynandrous specimen whereof the right side is female, very dark and small, the left side—male—being ordinary, but the antennæ intermediate, *both* shortly pectinated, much less so than in an ordinary male. This form seems to be almost unexampled.

The female varies very greatly in the degree of dusting, some being nearly white and very pretty, others in every possible degree of increase of duskiness to a very dark and clouded shade, yet it does not seem ever to assume the smooth unicolorous dark form in any degree, the stripes being almost always manifest. In the collection of the late Rev. H. Burney was a yellowish-white specimen, devoid of markings except a faint brown shade near the hind margin; and Mr. Webb has one silvery-grey, without markings, except a slender black submarginal line and the usual dusting; another in which the stripes are massed together in the inner half of the wing and the outer half is silvery-white; and a

third having all the transverse stripes reduced to mere threads except the fourth, which is broad and black, and forms a striking submarginal band. Specimens in which the base is clouded with black, or the second and third stripes are joined, and sometimes the first and fourth nearly obliterated, are not rare in collections, and to enumerate all the intermediate forms would be a hopeless task.

On the wing from the end of April till June, and in a partial second generation in August.

LARVA moderately stout, wrinkled at the sides, head rather large and triangular. Very variable in colour and markings, all shades of brown, greenish-brown, ochreous, purple and grey; sometimes with traces of pale dorsal lozenges, and occasionally with the subdorsal lines represented by rows of whitish spots; but frequently unicolorous; the only constant character is a more or less distinct pale ventral stripe. (C. Fenn.) Mr. Newman says that the front of the head has a slight resemblance to a human face, the central plate (or nose) being very distinct, but very flat; on the upper part of each cheek (lobe) is a pale patch, in which is a dark eye-like spot, and above this a dark crescentic mark much resembling an eyebrow!

July and August, and a partial second generation in September, on heather (*Calluna vulgaris*), heath (*Erica*), occasionally *Myrica gale*, *Lythrum salicaria*, but in default of these will eat bramble, dock, clover and other trefoils, sainfoin, broom, rest-harrow and even the blossoms of *Artemisia*; feeding at night, resting during the day rigidly and stiffly extended upon its food plant, feigning death if disturbed.

PUPA stout, shining, anal extremity with a long spike; red-brown; wing and limb-cases tinged with green and rather transparent; spike dark brown. Subterranean, not in a cocoon. (C. Fenn.)

The moth flies by day, or sits openly upon the top of the heather, and if the sun is shining flits away at once when



seen, but in cloudy weather permits a close approach, so that one can see how, with wings widely open and depressed, its colour and markings bear a most accurate resemblance to the double row of last year's withered blossoms still attached to the flower stalks of the heather; or, in the more richly-marked and coloured specimens, to the feather of a grouse lying upon the sprays. So far as has been observed it does not fly at night. both sexes being equally common and lively in the daytime.

One of our most abundant insects, frequenting all heaths and usually in such numbers as to be disturbed at almost every step. Less abundant but still frequent in woods and fens, or anywhere in which a few plants of heath or ling may be found. Its range seems to extend throughout the United Kingdom except Shetland. Abroad it ranges over the whole of Europe except the extreme North and South; Tartary, and the mountainous regions of Central Asia; also Maine, New York State, and other parts of the United States of America.

2. **F. piniaria**, *L.*—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Wings of the male creamy-yellow or white in their inner area; apical half, with costa, nervures and dorsal margin, brown-black. Female fulvous or orange-brown, with a similar margin red-brown.

Antennæ of the male strongly pectinated with long solid ciliated teeth to the tip, black-brown; palpi extremely small, hairy, black-brown; head rough, pale ochreous, embellished with black bristles, especially so on both sides of the lower portion of the face; thorax black, but loosely covered with long raised clouded yellow scales; abdomen dull black, dusted with ochreous; lateral and anal tufts small. Fore wings much elongated; costa arched at the base but straight or almost hollowed in the middle and but slightly arched towards the apex, which is decidedly angulated; hind margin long, very oblique, moderately curved; dorsal margin straight; colour pale yellow, yellowish-white, or white; nervures

blackened; costal region dotted with black-brown, and the dorsal margin clouded and blackened with abundance of similar dots, a broad streak of which also lies along the median nervure from the base; the entire hind-marginal and apical portion from the middle, except the costa, is occupied smoothly with black-brown or black, in which the nervures are sometimes faintly indicated in whitish dusting; cilia chequered, black and white. Hind wings elongated, rounded behind; ground-colour as in the fore wings but much obscured by a dusting of black-brown dots, and from the base by smoky clouding and long smoky-brown hairs; along the costal region is a broad black-brown stripe to the apex, this is continued along the hind margin as a narrow broken border; the middle of the wing is crossed by two obscure, dusted, black slender bands; cilia white or dusky-white, irregularly barred or dashed with black. Female of about the same expanse, antennæ simple, body stouter; all the wings pale orange-brown, fulvous, or yellow-brown; the markings very nearly as described in the male, but less distinct; the darker portions being dull umbreous or reddish-brown, divided by lines of red or brighter brown along the nervures; usually also there are indications of two smoky-brown transverse stripes from the costa beyond the middle, which wholly or partially cross the fore wings and are represented upon the hind; cilia of all the wings white, chequered or dashed with brown.

Underside in both sexes exceedingly pretty, the hind wings especially so, the ground-colour of the fore wings more creamy-yellow, smoother pale brown, or clearer white; the dark markings formed as on the upper side except that in the dark blotch the costal portion is clouded with yellow or white, in which is a dusting of red-brown; cilia chequered as above. Hind wings white, longitudinally striped with yellow-brown or red-brown and dusted with the same: in the middle are two red-brown transverse stripes blackened at intervals; cilia yellow or white dashed with brown.

Variation in this species seems to be in some degree climatal. In the south the ground colour of the male is ordinarily creamy-yellow, of the female orange-brown; but in hill districts and from the middle of England northward it is almost invariably white or even greyish-white in the male; that of the female varying from pale yellow through various shades of yellow-brown to dull pale umbreous. But it is noticeable that males of the white form occur along with those of the creamy-yellow variety throughout the South of England, being often supposed to be simply washed or faded specimens; yet the females which accompany them appear in no case to lose their rich orange or fulvous hue, those of the more dull and brown colouring being to all appearance confined to more Northern localities. In some Midland districts, as in Derbyshire and Staffordshire, the yellow males and fulvous females still occur as the scarcer form. The browner females vary a great deal in tone of colouring and in the streaking of the nervures in the dark blotch. In the white males the colour of the hind wings is unstable, the white area in some occupying the greater part of the wings, in others being almost obliterated by brown clouding.

The dark slender transverse obscure stripe which so often crosses the middle of the fore wings in the females is not unfrequently reproduced in males of both white and yellow varieties. In Inverness-shire Mr. J. J. F. X. King has taken a smaller race, of which the female is dull brown, and the richness of markings almost lost, indeed, one of these has no markings at all upon the underside of the hind wings except the white stripe from base to hind margin interrupted by black-brown spots. A still smaller race is found by Mr. Arthur Horne at Aberdeen, averaging hardly more than one half the normal size. In a specimen, of the ordinary size, in Mr. Sydney Webb's collection the dark transverse stripe which sometimes occurs has become a broad and conspicuous black-brown band; and there is a record of a wholly black example taken in Berkshire. Mr. W. P. Blackburn-Maze

has a beautiful specimen, taken in the same county, of which the costal and apical dark areas of the fore wings are of a peculiarly rich deep brown-black, and the hind wings wholly smoky-black except a single yellowish dash; he has also a gynandrous example in which the right side is male and the left female.

On the wing at the end of May, and in June, in the north lasting into July.

LARVA smooth, elongated, cylindrical or very faintly tapering towards the head, which is fairly large; bluish-green or whitish-green; dorsal line white or pale yellow edged on each side by a black fine line; subdorsal line white, similarly edged; spiracular stripe broader, pale yellow, edged above with dark green; undersurface striped alternately with dark and light green; spiracles deep yellow; head of the colour of the body, and exhibiting the same stripes, which are complete from this to the anal extremity; divisions of the segments edged with greenish-white; feet dark green.

August till October upon Scotch fir (*Pinus sylvestris*), feeding upon the leaves (needles), to which from its colour and complete longitudinal lines it bears a most accurate resemblance. Also on larch and silver and other firs.

PUPA very compact, short, thick and shining; wing-covers thickened; limb-covers very smooth; antenna-cases just showing the pectinations; sculpture of incised lines on the wing-covers excessively minute and the pitted dotting of the segments also minute and rather sparing; hinder portion of each segment smooth, and distinctly banded; anal segment bluntly rounded off and having a thick cremaster in the form of a flattened cone, hollowed beneath and tapering to a short spike. Colour of the wing and limb-covers deep dark greenish-brown or olive-black, of the dorsal region and abdominal segments dark red-brown, of the cremaster black-brown. Among the fallen fir needles on the ground, at about one and a half inches deep, in a very slight silken cocoon.



In this state through the winter.

One of the most active and energetic of moths in the day-time. The male flying all day long in the sunshine, or when only moderately cloudy but warm, keeping usually high up about the branches of the fir-trees ; not deterred by a strong wind if the sun is out, but fluttering along the sheltered sides, tumbling headlong at a sudden gust, struggling up and beating against it again and again, or resting a little while among the fir-needles, and then flying wildly as before. But a heavy rain-storm will drive them to shelter beneath the trees among the dried ferns or upon any long coarse grass or sedge, on which they may sometimes be seen in hundreds. All this time the females are usually sitting among the fir-needles and when beaten out with a long pole will come aimlessly fluttering downwards. They may be secured, however, before they mount to this elevation ; since emergence from pupa takes place about 4 P.M. when both sexes may be found under the trees, drying their wings on the grasses, and may be secured with perfect ease. The male always sits with wings quite erect and pressed together, but the female does not always assume this posture, the wings being sometimes spread rather obliquely.

Abundant throughout the United Kingdom in fir-woods only ; and in some districts found about scattered or single fir-trees. The female appears to fly at night, and has been taken, attracted by powerful lights, at such a time, at a distance of many miles from fir-woods, apparently travelling in search of some suitable place for the deposition of eggs. Although so plentiful now, there are grounds for a belief that it is a comparatively recent immigrant, at any rate, to our *Southern* districts. Donovan, writing at the end of the last century—and figuring the male—says : “ This rare and curious species has been for some time admitted to the cabinets of English Natural History, but on the most dubious authority,” but he goes on to tell of its discovery in

plenty in Scotland! This migratory movement seems to have been continued more recently, for the Rev. John Bristowe of Belfast told me some years ago that it appeared quite suddenly in the fir woods about Slieve Donard, and elsewhere in the Mourne Mountains, in the County Down, Ireland, having certainly been absent for many previous years, and having apparently quite recently migrated thither.

Abroad it abounds in suitable districts throughout Central and Northern Europe, the North of Italy and Spain, Eastern Siberia, and the mountain regions of Central Asia.

3. **F. pinetaria**, *Hüb.*; **brunneata**, *Staud. Cat.*—Expanse  $\frac{7}{8}$  to 1 inch. All the wings dark tawny-red, indistinctly cross-striped with tawny-brown; more distinctly so in the female.

Antennæ of the male pectinated with short, solid, rather distinct, ciliated teeth, black-brown; palpi pointed, brown with the tips black; head and thorax roughened with raised scales, and having between them a noticeable ridge, red-brown; abdomen smooth, slender, reddish-brown dusted with darker; lateral and anal tufts very small. Fore wings not broad; costa gently arched throughout; apex bluntly rounded; hind margin more evenly curved, and the dorsal margin very slightly so; tawny-red or reddish-chocolate, with three slender, sinuous, transverse red-brown stripes, rather obscure, and representing the first, central, and second lines; and beyond them a fourth, more sinuous, but often incomplete or only indicated towards the costa; discal spot very faint, red-brown; cilia concolorous. Hind wings rather long, rounded, paler red-brown with a dusting of brighter orange-red; the three transverse complete lines of the fore wings continued but more slender, dull red-brown; hind margin tinged with deeper chocolate-brown; cilia similar but spotted with a paler shade. Antennæ of the female simple; all the wings of a paler red-brown, but the transverse stripes broader and more noticeable, and thickened upon the costa, the fourth

also being complete on the fore wings and suggested on the hind; central spot of the hind wings distinct, red-brown; cilia rather darker; otherwise similar.

Underside rich golden-brown, with a single, more red-brown central transverse stripe which is continuous through all the wings; occasionally there are faint indications of another nearer the base. Body and legs pale yellow-brown dusted with grey.

The male is hardly variable to any appreciable extent, but in the female the central stripe of the fore and hind wings is in some specimens almost obliterated, and in others displaced in the direction of the first line so as almost to coalesce with it.

On the wing in June and July and sometimes till the beginning of August.

LARVA over half an inch in length, of uniform bulk, cylindrical. the head horny, reddish-brown, the skin smooth but puckered along the spiracles; the colour disposed in a multiplicity of fine lines—the dorsal line, which widens in the middle of each segment, is dark green, closely edged with almost black threads; then a thin white line; then the sub-dorsal line of pale pinkish-brown outlined with darker brown; then another thin white line; then three olive-brown lines, the middle one the palest and the lower darkest, partly distinct and partly run together so as to form a stripe just above the spiracles; spiracular line broad, white, but tinged with yellow in the middle of each segment; under-surface dirty white, with some oblique dashes and lines of brown.

When younger the ground colour is pale grey, almost white, the dorsal and supra-spiracular lines almost black; the subdorsal brown; and the spiracular stripe tinged with yellow. (Rev. J. Hellins.)

March and April, or even the beginning of May; on whortleberry (*Vaccinium myrtillus*), eating at first the young

leaf buds, then the leaves; evidently assimilating very closely to the colour of the stems of the food-plant.

The winter is passed in the egg state.

PUPA apparently undescribed. In the earth.

The male moth flies in the sunshine in a lively manner, over the whortleberry and heather in its favourite haunts in mountainous districts of Scotland, very often in open woods of large old pines and birches, but it hardly ever leaves the immediate vicinity of its food-plant, upon which also the female usually sits, being more sluggish than her mate. So far as these Islands are concerned it was discovered in 1825 in Perthshire by Messrs. Curtis and Dale; and has only been noticed in Scotland. There it is found, besides Perthshire, in Aberdeenshire, Inverness-shire, Ross-shire, Moray, and I believe in Sutherlandshire. Abroad in Central and Western Europe, Eastern Spain, Northern Italy, Southern Russia, Tartary, the mountainous regions of Central Asia, and Japan. Moreover there are in the British Museum examples labelled as from Texas, North America, but if these are correctly labelled its range on that Continent must surely be more extensive.

4. **F. conspicuata**, *Schiff.*; **limbaria**, *Staud. Cat.*—Expanse 1 to  $1\frac{1}{8}$  inch. Wings all orange-yellow, the fore wings rather dusted with black, more so towards the costa; apex and hind margin smoky-black. Hind wings much more thickly dusted.

Antennæ of the male pectinated with rather short, solid, ciliated teeth, black-brown; palpi small, hairy, dull brown; head and thorax rather rough, black-brown abundantly dusted with yellow; abdomen moderately slender, black, very smooth, dusted all over with pale yellow; lateral tufts hardly perceptible; anal tuft small. Fore wings triangular, costa nearly straight, apex bluntly angulated; hind margin gently rounded, very oblique; dorsal margin hardly straight;



colour rich ochreous, or orange-yellow, with a moderate sprinkling of black atoms; costal region darkened by a thicker dusting of cloudy brownish-black; apex and hind margin more broadly margined with black-brown; cilia purplish-brown. Hind wings rather long, gently rounded and crenulated behind; the apical and anal angles rather fully indicated; colour somewhat paler orange-yellow with a faint purple flush, and more plentiful dusting of black-brown, which accumulates towards the hind margin into an ill-defined blackish border; cilia purplish-brown. Antennæ of the female simple; body rather stouter; colour of fore and hind wings lighter orange-yellow with less dark dusting, especially on the hind wings, and a more distinctly dark band along the hind margins, this indeed being sometimes dark purplish-brown, or nearly black.

Underside of the fore wings of the same colour as the upper, but dusted all over with black-brown dots and perpendicular streaks, which are larger and more crowded on the costal and hind marginal areas; cilia pale yellow-brown, dusted with dark brown. Hind wings very different, yellowish-white with every nervure abundantly dusted, and broadly rippled, with mossy streaks of black-brown; between nervures four and six is a white stripe lengthwise from the base to the hind margin, and another, not quite so distinct lies between the second and third, while the hinder spaces between the other nervures are more shortly white; cilia white, mixed with black and brown. Body and legs white, dotted with brown and black; tarsi browner.

Usually but little variable and only in the degree of black dusting, which in the male sometimes suffuses the hind wings and renders them smoky black. In Dr. P. B. Mason's collection is a specimen wholly black except a tinge of yellow in the middle of the fore wings.

On the wing in May and the beginning of June, and as a partial, or complete, second generation, at the end of July and in August.

LARVA rather short, stout, and smooth; head rounded, not polished, dull green dusted with brown, and with a distinct brown dash in the middle of each lobe; body clothed with a few scattered short hairs, variable, grass-green, dark green, or bluish-green; dorsal line grey, edged on each side by a line of a paler shade of the ground colour; subdorsal line whitish or yellowish, enclosed between two grey threads; between the dorsal and subdorsal lines is often another grey thread, and two similar threads between the subdorsal line and spiracular stripe, which last is broad, conspicuous, pale yellow or yellowish-white, distinctly margined on both sides with black, and not continued upon the anal flap; under-surface of the ground colour with four yellow longitudinal lines, the two in the middle most distinct; legs pale brown dotted with dark brown; prolegs tipped with brown. (C. Fenn.) Mr. Buckler has figured a variety in which all the green colouring is replaced by purplish-brown.

June, and a second generation in August or September, on broom (*Spartium scoparium*) and sometimes on Genista. In both generations feeding up with great rapidity.

PUPA stout, rounded, tapering rapidly behind; surface shining but roughened, dull purplish-brown: anal extremity furnished with a long spike. Subterranean, sometimes enclosed in a very slight silken cocoon, which however is often wanting. (C. Fenn.)

The winter is passed in this state.

The moth flies actively by day in hot sunshine; in cloudy or wet days and at night rests on the undersides of the broom bushes with its wings shut closely together, erect above its back, like a little butterfly. Only to be found about these bushes, and now very scarce, or excessively local in its distribution in these islands; but forty years ago it was very plentiful at Stowmarket and elsewhere in Suffolk, and in Essex and Kent; probably it still exists in isolated spots in these counties. Its destruction seems to have been

in part caused by the ploughing up, and burning off, the large broom fields which formerly existed; yet in the year 1851 my colleague, Mr. J. W. Douglas, wrote that it had formerly been plentiful among broom at Birch Wood, Surrey, but was then extinct. I know of no probable locality for it now in this county. There is a record of its occurrence in Devon; and these five counties seem to include the extent of its modern range in England. In Scotland, Dr. F. Buchanan White recorded its occurrence (as a larva) at Pitlochrie, Perthshire, and Mr. H. T. Stainton added Dunkeld and Bridge of Earn in the same county. I know of no other records in the United Kingdom. Abroad it is somewhat local, being apparently confined to Northern and Central France, Belgium, Holland, Southern and Western Germany, Switzerland, and Northern Italy.

5. **F. carbonaria**, *L.*—Expanse 1 inch. Wings white, dusted almost all over with black; having four or five rather erect irregular transverse black stripes on the fore wings, and similar more angulated stripes on the hind.

Antennæ of the male pectinated with stiff solid oblique ciliated teeth, black-brown, back of the shaft black, dotted with white; palpi pointed, black-brown, concealed among abundant hair-scales projecting forward from the head; the latter, with the thorax, is therefore very rough, black dotted with white; abdomen slender, smooth, black, barred on each segment with white; lateral tufts obsolete; anal tuft small and compressed. Fore wings pointed and rather narrow; costa arched at the base, and a little so at the apex, but between these almost hollowed; apex angulated; hind margin oblique, hardly rounded; dorsal margin straight; ground colour white, but almost concealed under abundant dusting of black; first line a little curved; second more angulated, both rather erect and thickened into black stripes; central stripe similar, even broader and *more* erect, placed very little beyond the first; and another black stripe is

placed before the hind margin, and is thickest towards the costa; from this a fifth stripe of the same colour, lying along the hind margin, is separated by a slender dotted line of the white ground colour; cilia white chequered with black. Hind wings rather narrow, rounded behind; white, dusted and striped as in the fore wings, except that one black stripe is omitted; cilia similarly chequered. Female very similar.

Underside a repetition of the upper, but the stripes, on all the wings, grey rather than black. Body and legs black, dusted with white.

Very constant in colour and markings, but in the collection of Mr. S. J. Capper is a female specimen in which the stripes are strongly marked, of an unusually deep black.

On the wing at the end of April and in May.

LARVA. Head slightly narrower than the second segment, not retractile; body uniformly convex above, somewhat dilated at the sides, where there is a very distinct undulated skin-fold below the spiracles; colour of the head dull brown, face variegated with whitish-brown; dorsal surface of the body dingy wainscot-brown, of two shades, disposed in very obscure rivulet stripes; this is bounded on each side by the pale skin-fold, and where it meets this is much darker, its darker margin coming into immediate proximity with the pale skin-fold makes the latter more conspicuous; minute dorsal raised dots black; spiracles pale, with black rings; ventral rather paler than the dorsal surface, and a broad median stripe still paler; legs and prolegs of the colour of the ventral surface. (E. Newman.)

June and July on birch and willow, especially *Salix cinerea*, feeding at night; hiding during the day on the underside of a leaf.

PUPA apparently undescribed; on the ground among fallen leaves.

The winter is passed in this condition.



The moth flies in the sunshine over heather, on mountain sides, at a considerable elevation, and is exceedingly local, but not scarce. Its only certain localities in these Islands are in Scotland, and are confined to mountains in Perthshire, Aberdeenshire, Inverness-shire and perhaps West Ross; a statement of the capture, many years ago, of a specimen on Ingleborough, Yorkshire, having never been confirmed, and being very probably erroneous. Yet there appears to be no reason why it should not occur on the mountains of the Lake District. Abroad it is found on the Alps, the mountains of Silesia and other parts of Germany, in Livonia, Finland, Lapland, and Norway.

### Genus 13. **NUMERIA.**

Antennæ obliquely pectinated in the male, minutely dentate in the female; palpi distinct; head, thorax and abdomen smooth, the latter not very slender; fore wings broad, with strongly arched costa, and pointed apex hind wings broad.

We have but one species.

1. **N. pulveraria**, L.—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Wings all brownish-drab, dusted with chocolate; middle of fore wings occupied by a broad complete chocolate transverse band, outwardly excavated; on the hind wings is an incomplete clouded narrow band of the same colour.

Antennæ of the male pectinated with rather short, oblique, solid teeth, thickly ciliated throughout, and at their tips rather thickened, light brown; palpi short but distinct, golden-brown; face smooth pale drab, separated from the upper part of the head, which is less smooth, by a transverse channel; head, thorax, and abdomen golden-brown, all moderately smooth; lateral tufts hardly perceptible; anal tuft small. Fore wings very broad; costa more than usually arched throughout; apex sharply angulated; hind margin smoothly and regularly curved; dorsal margin also a little

rounded-out and fully ciliated; general colour brownish-drab with abundant fine dusting of chocolate-red; the whole middle area is occupied by a very broad velvety golden-brown, or chocolate, band, the inner edge of which is the first line, rather waved and sometimes darkened, the outer being the second line, toothed and angulated from the costa to the middle, excavated below it; cilia of the ground colour. Hind wings broad, rounded behind, the apex and anal angle fully developed; colour and dusting as in the fore wings, but paler towards the costal edge; a narrow central transverse but incomplete chocolate stripe arises from the dorsal margin and barely extends one-half across the wing, it is shaded off on its upper side; cilia reddish-brown. Female very similar but rather larger and stouter. its antennæ faintly dentate.

Underside wholly bright golden-brown; the fore wings shaded off paler to the dorsal margin; the hind wings abundantly dusted with red-brown, and from the middle outward faintly shaded with purple-red. Body golden-brown; legs more yellow-brown.

Not very variable, but some of those in which the band of the fore wings is darker chocolate have also all the wings dusted with purplish-chocolate or purple-brown, the more purple tint showing itself towards the anal angle of the hind wings. Some specimens reared by Mrs. Hutchinson at Leominster, Herefordshire, have the band of the fore wings somewhat greenish-brown. The form found in some parts of Asia, in which the dark band is wholly or partially obliterated by a general stippling of purple-brown, is not represented here.

On the wing from the end of April till June.

LARVA twig-like, long and slender, having a transverse bifid dorsal hump on the ninth segment and two small dorsal tubercles each on the tenth and twelfth; also three very minute anal points; head rather large, bifid, truncate in front, ochreous-brown, the mouth yellowish; body ochreous-

brown mottled and shaded with pale purplish-brown or chocolate, which forms a broad dorsal shade edged with pale yellow on the fourth and fifth segments; prominences slightly darker; spiracles black, conspicuous; prolegs emerald or sea-green; undersurface of the ground colour with a whitish stripe containing a purplish line; often with conspicuous **V**- or **U**-shaped markings on the undersurface of the fifth and sixth segments and continued to the sides.

Or—Purplish-grey, clouded and mottled with ochreous, especially on the sides of the first four segments, and on the back from the eighth segment; projections ochreous, dusted with black. (C. Fenn.)

June till August or September, on birch, willow, oak, hazel, ash, and wild cherry; feeding at night, and growing very slowly.

PUPA rather cylindrical in the thoracic portion, and somewhat elongate; eye-covers prominent; antenna-covers neatly sculptured with excavated cross-lines; the remaining surface smooth and glossy; cremaster broad but tapering to a point, and tipped with two or three minute curved bristles; colour red-brown, wing-covers tinged with olive-green; eye-covers and cremaster black-brown. In a thin silken cocoon formed of a drawn-together dead leaf or portions of moss or rubbish in any crevice upon the ground.

The moth sits during the day with depressed, extended wings, usually on the upper side of a leaf, quite conspicuously, on low-growing herbage in an open wood-path at the edge of a wood or copse, or on a hillside or hedgerow in a well-wooded district, and may be taken into the hand. When disturbed it will only flutter down to the ground or to a similar spot close by. Its natural flight is at dusk, but it is not even at this time very energetic, and if seen sitting upon a leaf is found then to carry its wings erect. Hardly ever abundant, but found in suitable and favourite spots throughout the South and West of England, and more locally in the

Midlands and Eastern Counties, perhaps being, in some of the more sheltered woods in the Midland Counties, more plentiful than in southern localities. I well remember, as a boy, the pleasure I experienced in finding this pretty species in plenty, sitting, along with *Abraxas ulmata*, in wood paths at Benthall Edge, Salop. Northward, more local or more scarce, it extends to Cumberland and Northumberland; also throughout Wales, both north and south, being by no means rare in the lanes in Pembrokeshire. In Scotland it is found in the Solway and Clyde districts, Argyleshire, Aberdeenshire, Kincardineshire, Moray, West Ross, and the Orkneys; and in Ireland in Wicklow, Kerry, Galway, Sligo, Monaghan, Cavan, Tyrone, Antrim and Derry. Abroad it has an extensive range through Central Europe, all the temperate portions of Northern Europe, Northern Italy, Bulgaria, the Ural mountain districts, Tartary, the mountain regions of Central Asia, Corea, Japan, and throughout North America, apparently, from Anticosti to Vancouver, and from South Carolina to California.

#### Genus 14. SCODIONA.

Antennæ of the male shortly pectinated; palpi minute; head, thorax and abdomen smooth, not very slender; fore wings elongated, the tip produced; hind wings rather narrow and elongated towards the apex. Female stouter and much smaller.

We have but one species.

1. *S. belgiaria*, Bork.; *favillacearia*, Hüb.—Expanse, male  $1\frac{1}{2}$  inch, female  $1\frac{1}{4}$ . Fore wings long with straight costa and expanded hind margin; white dusted with grey and having two transverse lines and a spot reddish-black; hind wings very similar. Female smaller, greyer.

Antennæ of the male pectinated with slender solid oblique teeth, which are fully ciliated, and the two rows placed near each other, brown; palpi of the same colour, very small and slender; head smooth, pure white; thorax rather loosely

covered with long smooth scales, brownish-white ; abdomen similar, smooth, faintly banded with grey dusting ; lateral and anal tufts small. Fore wings long and produced towards the apex ; costa straight or almost hollowed in the middle, but very faintly arched at the base and apex, which last is decidedly angulated ; hind margin fully curved and rather expanded, the curve running on to the dorsal margin ; colour white or greyish-white, faintly or else more fully, dusted with black and brown ; first line perpendicular and rather straight, consisting of three dark brown, or black, spots placed on nervures and faintly connected together ; second line very oblique, placed in crescents throughout, and forming a black arrow-head on each nervure ; outside this are two black-brown cloudy blotches, one above the middle, the other below it ; discal spot ovate, erect, reniform, black ; often the transverse lines and the nervures are shaded or dusted with yellow-brown ; extreme hind margin dotted with black and faintly edged with reddish-brown ; cilia white, faintly shaded with the same colour. Hind wings of moderate breadth, rounded behind ; silky-white dusted with grey-brown ; central spot brown, followed by a slender sinuous transverse line of small brown spots ; hind margin bordered with dots of cloudy black-brown ; cilia white, shaded with light brown. Antennæ of the female simple ; body much stouter but wings decidedly smaller ; their whole surface, but that of the hind especially, more dusted with brown or grey-brown, the stripes and blotches broader and darker, and the stripe on the hind wings clouded and continuous ; cilia greyish-white ; otherwise similar.

Underside of the fore wings pale smoke-colour or smoky-white ; the black discal spot, and the second line with its black dashes, distinctly visible. Hind wings very silky, white, the central spot black and conspicuous, followed by a row of black-brown spots ; cilia clouded with brown. Female with the underside of the fore wings of a darker shade, and the hind wings dusted with black-brown.



Not very variable, except possibly in the form of local races—that found in the New Forest, Hants, being unusually white in the male, though, if anything, darker in the female. On the other hand the female in Scotland is sometimes quite of the colour of the other sex. In the collection of the late Mr. F. Bond is a female of a smoky-black colour; and Mr. Sydney Webb has a male in which the first and second lines are so drawn together as to meet on the dorsal margin. One of the same sex in Mr. S. J. Capper's collection has the ground colour suffused with reddish-grey dusting and the transverse stripes much shaded with red-brown. Mr. G. T. Porritt has another such, also a female similarly but more deeply clouded, and another in which the transverse stripes are thickened and very black.

On the wing sometimes at the end of May, also in June, July, and even August, influenced apparently both by weather and climate. Mr. F. C. Woodforde informs me that in both 1893 and 1894 he took specimens in the New Forest in the last week of April; but that upon Cannock Chase, Staffordshire, and in Shropshire, it may be found in August, and has actually been captured when looking for *Stilbia anomala*. Yet there is no indication of a second generation in the year; all seem to belong to one extended brood.

LARVA moderately stout, the sides much wrinkled; a thorn-like projection on the twelfth segment points backward; on the previous segments, from the fifth, the dorsal spots are raised into little warts; anal segment furnished with two long projecting points; head rather small and rounded, dull purple; face whitish; body dull purple; a broad whitish or pale grey dorsal stripe proceeds from the head to the end of the dorsal projection on the twelfth segment, on the way dividing pairs of pale grey or whitish spots at the incisions of the segments; sides blotched with pale grey, which is continued as a distinct line down both pairs of prolegs; under-

surface unicolorous dull purple with faint indications of two paler median lines. (C. Fenn.)

July till April or even May, on *Calluna vulgaris* (heather), *Erica cinerea* and *E. tetralix* (cross-leaved, and bell heaths), feeding at night. It is said to remain quiescent in hybernation from early autumn till March, afterwards feeding up rather rapidly.

PUPA elongate, lively, anal extremity armed with a short spike; dark bistre-brown, the incisions of segments, and the abdomen tinged with dull yellow or orange. (C. Fenn.) In a slight cocoon among twigs of heath lying upon the ground.

The moth inhabits boggy heaths, moors, and mosses; and during the day sits on the ground, choosing the blackest earth to rest upon. Curtis records this habit, saying that it selects the most peaty spots on heaths, and looks like a little stone upon the ground. It is so sluggish that it may then readily be boxed. Occasionally in the hottest sunshine it may be trodden up and induced to fly, but this, curiously enough, seems only to be the case with the female, which when on the wing looks quite like *Ptilonia atomaria*. The male flies at dusk but even then is sluggish and easily captured. Possibly—indeed certainly—from these curious habits, it is often overlooked, and probably exists on heaths in many counties from which it is not recorded. Formerly it was common at Shirley, Surrey, only a few miles from London, but seems now to have quite disappeared thence—perhaps more trampled out by the numerous feet introduced by incessant excursions and picnics, rather than exterminated by collectors. Still found in other parts of Surrey, and tolerably common in the New Forest, Hants, and in Dorset, also found in Kent, Sussex, and Berkshire. Curiously enough I find no records in the rest of the Southern Counties, nor in the Eastern or South-Western, but the insect reappears in Staffordshire, Cheshire, Lancashire, Yorkshire, and Cumberland, frequent-

ing mosses ; and is widely spread in Scotland, recorded from Berwickshire, Roxburghshire, the Pentland Hills and near Edinburgh, Wigtownshire, Dunoon, Loch Long, and Arran, Perthshire, Aberdeenshire, Kincardineshire, Sutherlandshire, and the Orkneys and Hebrides. I can find no record of its presence in Wales, but in Ireland it has a wide distribution in bogs, in the County Dublin, Cork, Kerry, Galway, Sligo, Westmeath, Leitrim, Armagh, Fermanagh, Tyrone, Down, and Derry. Abroad it is somewhat local, found in Northern France, Holland, Belgium ; and in a more obscure local variation in Southern and Eastern Russia.

### Genus 15. **SELIDOSEMA.**

Antennæ of the male densely plumose ; palpi small ; head and thorax smooth, the latter rather thick ; abdomen long, slender, and tapering ; fore wings broad, elongated, and pointed ; hind wings ample.

We have only one species.

1. **S. plumaria**, *Schiff.* ; **ericetaria**, *Staud. Cat.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inch. Antennæ of the male conspicuously plumose ; fore wings grey-brown with three red-brown costal spots, a narrow central stripe and the hind marginal region purplish-brown. Hind wings rather paler with a similar hind border. Female much smaller, its antennæ simple.

Antennæ of the male densely pectinated with long, very slender, ciliated teeth, or rather filaments which taper off below the apex, dark brown ; palpi slender, rather projecting, brown ; face smooth, top of the head rougher and separated by a transverse channel, dark chocolate ; eyes very black ; thorax not very thick, loosely covered with long purplish-brown hair-scales ; abdomen long and tapering, smooth and shining, silvery-brown dusted with black ; lateral and anal tufts small. Fore wings elongated, pointed, and rather trigonate ; costa mainly straight but slightly arched at the

base and apex, which is sharply angulated; hind margin very oblique, long and gently curved; dorsal margin nearly straight; colour grey-brown, dusted with brown and slightly with black; on the costa are three equidistant red-black spots; the first originates the first line, very obscure, dotted and a little curved; the second gives rise to a narrow distinct red-brown central stripe, in which is visible the small black discal spot; the third is the origin of the second line which, like the first, is brown but very indistinct, mainly visible by dots on the nervures; edging it outside is a stripe rather paler than the rest of the ground colour, and immediately succeeding this a broad red-brown band which fills the hind marginal region; within this band are a few irregular darker brown clouds which seem to indicate a subterminal line; cilia smoky-brown mixed with grey-brown. Hind wings elongated, large and broad, the hind margin bluntly angulated at the apex, and very slightly crenulated; ground colour and dusting as in the fore wings; central spot small and black; the middle area so tinged with purplish-brown as to indicate a broad but very obscure band; hind margin broadly occupied by a cloudy reddish-brown band, ill-defined on its inner edge; cilia smoky-brown. Female much smaller, with simple antennæ; wings more thickly dusted and the markings more diffused and obscured, or even partially absent; otherwise similar.

Underside of all the wings reddish-umbreous, freckled all over with a yellower tinge; discal spots visible, black-brown. Body and legs brown.

Not very variable, but occasionally, in both sexes, the central stripe throws off a broad shade of its own colour outwardly so as to form a faint broad band; in other cases, especially in the female, it is very nearly obsolete. This is conspicuously the case in specimens from the North of Ireland, where also both sexes are much reduced in size. (A similar small form is found in the South of Spain.)

On the wing in July and August.

LARVA about  $1\frac{1}{4}$  inch in length, and moderately stout in proportion; head narrower than the second segment, into which it can be partially withdrawn; face flat, and there is a slight depression on the crown; body of nearly uniform width throughout, and cylindrical, but the segments overlapping, and each being divided into sections by transverse ribs, together with the possession of a prominent ridge along the spiracles, give it a somewhat uneven appearance; the anal segment ends in a rather sharp triangular appendage, and the anal legs being set widely apart are very conspicuous; skin smooth, but tough. Ground colour uniformly pale stone-grey; head of the same colour, with a dark crescentic mark surmounting each mandible, and another similar mark above these; the mandibles are brown, of a still darker shade; a double black-brown line extends through the dorsal area; on the anterior segments it is paler and more uniform, but after it reaches the fifth it becomes swollen and darker in the middle of each segment, which gives it a conspicuous and rather interrupted appearance; subdorsal and spiracular lines pale grey, the latter rather prettily edged above and below with chocolate-brown, the brown being most noticeable on the anterior segments; the spiracles, and four very distinct dots on the dorsal area of each segment, intensely black. Ventral surface yellower-grey, with a broad median pale band enclosing a fine double reddish-brown line; outside the band, but adjoining it, on segments six to ten, is a conspicuous dark smoky mark; and between the pale band and the spiracular region is another faint pale line. (G. T. Porritt.)

September to April, on heather (*Calluna vulgaris*), feeding sparingly throughout the winter, always at night. At this time it may also be found resting upon the heath grasses, and may possibly sometimes eat them. Abroad it seems to have a more extensive range of food-plants, among which are included species of *Lotus*, *Vicia*, *Genista*, *Dorycnium*, and *Rumex*.



PUPA subterranean ; apparently undescribed.

The male moth flies rapidly over the heather in the daytime, in hot weather, and more gently towards dusk ; the female is more sluggish and very much more difficult to find. A local species, and confined to large heaths. Abundant in the New Forest, and also in the Isle of Wight, and along the banks of the Solent—all in Hants. About the year 1850 it was abundant near Farnham in Surrey, and more recently has been found commonly on Chobham Heath in the same county, but I have never seen it on the extensive heath tracts of the southern portion of the county. Very local in Berkshire and Dorset, but I have no further record in the South of England. Formerly found in several mosses near Preston, Lancashire, and quite recently at Meathrop Moss, in the north of that county. Apparently not observed in Wales or Scotland, but widely distributed on the heaths of Ireland—Glengarriff, Cork ; and common at Kinsale, Connemara, Killarney, Galway, Westmeath, Roscommon, King's County, and Armagh. Abroad it ranges through Western Europe, South Sweden, Central and Southern Germany, Switzerland, Galicia, Hungary, Spain, Armenia, and Palestine.

#### Genus 16. **SCORIA.**

Antennæ simple ; palpi slender, projecting ; head smooth ; thorax rough with long fluffy scales ; abdomen smooth, long and slender ; fore wings trigonate, broad behind, blunt ; hind wings very long, rather squared, markings of all the wings most visible beneath.

We have but one species.

1. **S. dealbata**, *L.* ; **lineata**, *Staud. Cat.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. All the wings creamy-white, the nervures, which are blackened on the underside, showing clearly through ; body white ; head and front of thorax tinged with yellow.

Antennæ of the male simple, minutely notched, faintly

ciliated, black-brown, powdered at the base with white; palpi slender, pointed, black; tongue exposed; eyes deep black; head rather smooth, yellowish-white; thorax tinged in front with the same and covered with long loose scales, which lie smoothly back, and shade off to pure white behind; abdomen long, smooth, moderately slender, white; lateral and anal tufts small. Fore wings elongated, bluntly pointed; costa nearly straight, only faintly arched at the base and apex, which is angulated; hind margin long, oblique, gently curved, dorsal margin also faintly rounded; extremely silky, creamy-white; nervures all visible as slender, hair-like, black-brown lines broadly shadowed from beneath; no other markings; cilia shining creamy-white. Hind wings elongated; the apex rather squared; hind margin beneath it faintly hollowed, thence rounded; colour and veining as in the fore wings; cilia similar. Female rather smaller, with the fore wings a little more pointed, and the body stouter, otherwise similar.

Underside dull creamy-white; costal region of the fore wings faintly clouded with yellow and grey; all the nervures, and a stripe down the middle of the discal cell in each wing, smoky-black, as also is a slender line around all the hind margins; cilia white. Body yellowish-white; legs long, purplish-brown, dusted with white.

Not variable.

On the wing from the end of May till the beginning of July.

LARVA rather elongated, smooth and stout, tapering considerably from the hinder segments towards the head, which is flat, rounded on each side, pale ochreous; general colour of the body ochreous or brownish-grey, but ornamented with so many waved and irregular lines that it is hard to describe; down the middle of the back is a double fine dusky line, which with the first subdorsal line, composed also of a double fine thread, forms a series of irregular figures by alternately

contracting and expanding; on the anterior and posterior segments the dorsal line becomes closer and darker; below the first subdorsal line is a stripe of yellowish- or reddish-buff, then comes another waved fine double thread; then the yellowish spiracles, scarcely distinguishable in a drab stripe, which is bordered below by a dusky line, followed by a reddish-buff line; undersurface drab with central and sub-ventral whitish lines; usual spots represented by fine black dots; and in one specimen the middle segments were suffused with a smoky hue. Legs and prolegs of the colour of the body. (Rev. J. Hellins.)

July to May on knot-grass, chickweed, dock, *Lotus major* and *L. corniculatus*, and most probably upon the larger wood-grasses; partially hybernating but recommencing to eat early in February. Abroad it is said to feed also upon *Hypericum*, *Origanium*, *Achillea*, *Lamium*, and *Centaurea*.

PUPA very lively, yellowish, the segments clouded with darker, and a peculiar, double-pointed, crown-like, little horny prominence on the anal segment; cremaster shining, with two straight pin-shaped points at the end. (Hofmann.) In a spindle-shaped cocoon of yellow silk attached to the upright culm of a last year's seed-stem of grass.

Having no personal experience of this moth I gladly avail myself of Mr. W. R. Jeffrey's observations. He says that it flies naturally in the sunshine. He particularly noticed this, since the insect is usually disturbed from long grass by walking through it. This he found was the case on dull days, but in the hot forenoon, when the sun was shining brightly, they were to be seen starting up from various parts of the hillside when there was nothing to disturb them. The female he noticed to be sluggish and to fly reluctantly in the sunshine; after taking a short flight it would settle on a blade of grass, then commence sliding down in a series of grotesque jerks for about two-thirds of its length, and bending the abdomen round deposit from two to six eggs in a row on

the edge of the concave side of the grass. It would then fly away and repeat the process elsewhere, but, if alarmed, mount high into the air and fly to a considerable distance. The grass most frequently chosen appeared to be *Brachypodium sylvaticum*, yet, curiously enough, the resulting young larvæ declined to feed on this or any other grass, and accepted *Polygonum aviculare* and *Lotus*.

Excessively local in this country, and only to be found in numbers in a few localities in Kent—from some of which it is rapidly disappearing—rare in Sussex and Dorset; once taken in the Cotswold district of Gloucestershire by the Rev. Joseph Greene, and once in Hertfordshire by the Rev. G. H. Raynor. Curtis recorded it—besides Kent—near Langport, Somerset, and in the Holt Woods near Stourton Caundle, Dorset. A locality in Ireland, recorded by the late Mr. E. Birchall, was, in all probability, given in error. I know of no localities for it, other than those enumerated, in the United Kingdom. Abroad, though very local, it is widely distributed in Europe, and is found in Asia Minor, Bithynia, and Tartary.

#### Genus 17. ASPILATES.

Antennæ of the male pectinated, rather short; palpi prominent; head and thorax roughened with long silky scales; abdomen long, smooth; fore wings elongated, bluntly pointed, rather narrowly trigonate; hind wings decidedly elongated, ample.

LARVÆ elongate, attenuated a little in front, not distinctly humped or twig-like, having a curious habit of coiling the anterior segments. On herbaceous plants or shrubs.

PUPÆ in the earth.

Our three species are readily discriminated.

A. Wings greyish-white, with grey-brown stripes.

*A. strigillaria.*

A<sup>2</sup>. Fore wings yellow.

B. Fore wings with an oblique grey-brown stripe running to the apex. *A. gilvaria.*

B<sup>2</sup>. Fore wings with two transverse stripes, the second oblique. *A. citraria.*

1. **A. strigillaria**, *Hüb.*—Expanse, male  $1\frac{1}{2}$  inch, female  $1\frac{1}{8}$  to  $1\frac{1}{4}$ . All the wings greyish-white or brownish-white, abundantly dusted with brown; on each are three straight transverse smoky-brown stripes, those of the fore wings oblique.

Antennæ of the male pectinated with oblique, solid, ciliated teeth, brownish-white; palpi short, chocolate-brown, dusted with white; head and thorax not very rough, white abundantly dusted with brown, but the neck white; abdomen long, slender, smooth, white dusted with brown, and in the middle segments often banded with brown or black; lateral tufts minute; anal tuft rather loose. Fore wings elongated; costa evenly and very slightly arched throughout; apex rather sharply angulated; hind margin smoothly rounded in a curve which attains the dorsal margin; greyish-white or brownish-white dusted over with dull pale brown, sometimes rather thickly so; first, central and second lines nearly parallel, very oblique, forming ill-defined smoky-brown, almost straight stripes, the central a little waved; outside these, and lying near to the hind margin, is very often a supplementary similar but paler stripe; cilia whitish-grey dappled with darker. Hind wings long and also broad, rather squared at the anal angle; hind margin faintly crenulated and not strongly rounded; similar in colour and dusting to the fore wings, except that the basal portion is often whiter; transverse stripes similar, often broader, not oblique, but the first placed very directly across the middle of the wing, the second beyond it, equally straight, but in a different direction, and the third more cloudy and placed just beyond; cilia greyish-white. Female



smaller, but with the body much thicker; antennæ simple; the wings whiter and less dusted; the first and second stripes of the fore wings drawn more closely together, and all more distinctly defined.

Underside of the fore wings pale smoky-brown, dusted with white, the nervures defined in darker lines, and beyond the middle an even, narrow, grey-brown, transverse stripe; hind wings much paler, white dusted with brown; nervures also visible, and the transverse stripe continued across the wing and more curved. In the female all the wings are white beneath. Body and legs mottled with white and pale brown.

Locally variable in the degree of brown dusting, which in the South of England is rather dense, in some specimens becoming very dark; paler and of a more reddish-brown tint in Ireland, or in some specimens almost white. The Rev. W. F. Johnson has found in the north of that country—on the heaths of the County Armagh—a race of extremely small specimens, hardly more than an inch in expanse, and equally pale. In Delamere Forest, Cheshire, is an intermediate race, very prettily marked with grey. The female seems everywhere to be the more susceptible of variation in the form and position of the transverse stripes, the central one of the fore wings and the first of the hind being sometimes clouded and much broadened; or one or more are absent, the possession of two stripes only on the fore wings and one on the hind being by no means rare. Occasionally the whole surface is suffused with grey-brown or umbreous, and one such, a male in the late Mr. F. Bond's collection, has but very slight traces of the markings. In a female in the same fine collection the first and central lines coalesce.

On the wing in June and July.

LARVA rather stout, swollen behind, slightly attenuated in front; incisions strongly marked, overlapping; dorsal spots

raised on the sixth to tenth segments, especially on the ninth, where they are united and form a small transverse protuberance; head small and rounded, pale grey, with purple markings on each side of the face; body dull purple, paler on the back, blotched, marbled, and dusted with dusky-white, reddish-brown, and grey; dorsal stripe pale grey, purplish in the middle, often obliterated on the sixth to the ninth segment; the protuberance upon the latter dull purple; a pale lateral stripe from the head ends in a whitish blotch on the fifth segment, but reappears on the ninth, and is continued to the anal extremity; subdorsal lines faintly indicated by series of small pale blotches; undersurface much paler than the back and sides, whitish-grey with a purplish tinge, and with numerous longitudinal, grey, threadlike lines; ventral spots black and distinct. (C. Fenn.)

August to May, on heather, heath, broom, and the blossoms of furze, hibernating when still small.

PUPA shining, red-brown. Not further described. In a slight cocoon among *débris* on the ground.

The moth frequents heaths, hiding in the daytime among the heather, from which it may be disturbed occasionally by beating, yet is not very willing to fly, and often slips down among the stems. Its natural flight is at early dusk, when it is easily secured. Found apparently on all large heath-tracts in the South of England, and in smaller numbers or more locally in moors or mosses throughout the country to Westmoreland and Cumberland, though scarce in the Eastern Counties, and hardly noticed on that side of the country to the north of Norfolk. I find no record in Wales, where it surely *must* occur; but in Scotland it is found in Roxburghshire and Clydesdale, in Aberdeenshire, Perthshire, and Ross-shire. In Ireland it has been found in Kerry, Galway, Sligo, Mayo, Westmeath, and Armagh, and is doubtless widely distributed on boggy heaths. Abroad it is common in Central Europe, the northern half of Italy, Livonia,

Turkey, the Balkan States, Southern and Western Russia, Asia Minor, Persia, Palestine, and the mountain regions of Central Asia.

2. *A. citraria*, Hüb.; *ochrearia*, Staud. Cat.—Expanse male,  $1\frac{1}{4}$  inch, female 1 to  $1\frac{1}{3}$ . Fore wings silky, bright yellow, a curved, narrow, pale purplish-brown stripe before the middle, and a straight oblique one beyond; hind wings white with a faint cross stripe.

Antennæ of the male pectinated with oblique, solid, ciliated teeth, the rows rather near together, smoky-brown, but the back of the shaft yellow; palpi slender, purple-brown, head yellow and rather smooth, tinged on the lower part of the face with purple; thorax slender, covered with long, loose, ochreous-yellow scales; abdomen slender, smooth, shining, pale yellow; lateral tufts very small, anal tuft compressed. Fore wings rather narrow; costa nearly straight; apex bluntly angulated; hind margin gently curved, and the curve sweeping round into the dorsal margin; colour clear bright yellow, a little tinged with ochreous at the base of the costa; first line curved, obscurely purplish-grey or purplish-brown, not attaining the dorsal margin; second line very oblique and direct, slightly rippled throughout, and reaching the costa just before the apex; of a washed-out purplish-brown shade; discal spot of the same colour but small and faint; cilia bright yellow. Hind wings rather elongated, silky, creamy-white; central spot a minute, faint, blackish ring; across the middle of the wing is a very faint, purplish-grey shade; cilia pale yellow. Female smaller but with the body stouter; antennæ simple; fore wings pale yellow, rather dusted with brown; the stripes more distinct, and the cilia spotted with red-brown. Hind wings hardly so white, and the spot and transverse shade broader.

Underside of the fore wings pale, semi-transparent, purplish-grey; the hind margin and broad apical region yellow;

the second stripe of the fore wings strongly marked, brown ; hind wings rich yellow, shading to white at the dorsal margin ; the central spot and cross stripe rich purple-brown and strongly accentuated. Body yellow-brown ; legs more tinged with pale purple-brown.

Rather variable in the shade of yellow of the fore wings and in the distinctness of the markings, which sometimes are suffused with yellow. In the collection of the late Mr. F. Bond are two males having these wings quite unicolorous yellow. Mr. Frank Norgate has a male in which the whole basal space of the fore wings to the first line is suffused with pale purple, and the outer stripe is extremely broad and strongly marked ; and also a female in which the two stripes are so curved as to meet on the dorsal margin, and form, between them, a distinct angle.

In Mr. Sydney Webb's collection are specimens of which the fore and hind wings are strongly tinged with smoky colouring, and the stripes of a leaden-purple ; also a large female which has the fore wings strongly dotted with purple-brown and the stripes deeply marked in the same colour.

On the wing in May and June, but in Southern Counties sometimes at the end of April ; a second generation appears in August and the beginning of September.

LARVA. Head a little narrower than the body, rather notched on the crown, putty-coloured, the lobes slightly tumid ; body of uniform substance throughout, without humps, but having the skin delicately shagreened ; there is a manifest skin-fold on each side, and the skin is also transversely wrinkled ; the thirteenth segment has, below the anal flap, two long, conical, acute points directed backward ; body putty-colour with numerous narrow, waved, longitudinal stripes of a darker tint ; of these the more conspicuous are five in number, and approximate, constituting a dorsal ornamentation ; the middle one, double during a part of its course, is more conspicuous and darker coloured towards the

head, where the others are less conspicuous and paler; spiracles dark brown. (E. Newman.)

September till April or May, and a second generation in June and July; on *Crepis taraxifolia*, *Daucus carota*, *Plantago coronopus*, and in confinement on various low plants, as *Polygonum aviculare*, *Lotus*, *Silene*, Scabious, Lucerne, and it has even been reared upon hound's-tongue (*Cynoglossum officinale*). It feeds at night, and remains by day at rest upon the leaves of its food-plant. If touched or disturbed it tucks in its head and coils the front portion of its body, and in this condition—as pointed out by Professor Poulton—bears a remarkable resemblance to a small blanched snail-shell.

PUPA rather slender and much attenuated at the anal extremity; beautifully variegated in two colours, wainscot-brown as the ground colour, and dark umbreous approaching to black for the ornamentation; this is disposed in oblique stripes on the wing-cases, leg-cases, and antenna-cases, in rings on the abdominal segments, and in diversified markings on the thorax and back. (E. Newman.) In a slight cocoon among leaves or rubbish.

The moth usually sits among herbage in rough fields, but the male will fly of its own accord in hot sunshine, and, unless the weather is cold, is always easily disturbed, though in cloudy weather only to fly to another patch of weeds. I have always found it fond of hiding among millefoil (*Achillea*), but this may be only for protection. It flies naturally at dusk, as does the female, for a very short time, but sits mostly upon grass-stems at night and in the dawn of the morning, and both sexes are readily attracted by light, even a hand-lantern proving a temptation. Evidently partial to coast districts, though not necessarily to the immediate vicinity of the sea, but to be found in the fields and on the hills of such districts, and sometimes commonly. It also is one of the species which especially frequent the ancient sea-sands, now far inland, of which there is an extensive tract in Norfolk,



Suffolk. and Cambridgeshire. Therefore common in the Eastern Counties from Kent to Norfolk, including Cambridgeshire, and also in Sussex, Hants, Dorset and Devon, and local in Cornwall. Apparently absent from many districts which seem to furnish sufficiently suitable spots, and, so far as I can ascertain, not recorded elsewhere in England, except that a most perplexing capture is on record at Silloth, Cumberland. It is, however, common upon the coast of South Wales to Pembrokeshire. So far as can be definitely ascertained, not known elsewhere in the United Kingdom. Abroad it is found in Central France, Corsica, of rather large size in Spain, also in Portugal, Turkey, and elsewhere in Southern Europe; and in Asia Minor, Syria, Cyprus, and Northern Africa.

3. **A. gilvaria**, *Schiff.*—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings pointed; straw-colour dusted with light brown; beyond the middle an oblique straight pale brown stripe points directly to the apex. Hind wings white.

Antennæ of the male pectinated with stiff solid oblique ciliated teeth. yellowish-grey; palpi minute, yellowish-brown; eyes dull black; head hardly roughened, pale yellow; thorax similar, slender, more fluffy with raised scales; abdomen long, smooth, yellowish-white; lateral tufts hardly visible; anal tuft pale yellow. Fore wings elongated, not broad; costa nearly straight; apex bluntly pointed; hind margin long, oblique, but only moderately curved, except at the anal angle; dorsal margin a little rounded; pale yellow or straw-colour, faintly tinged at the base and along the costa with ochreous; a single, straight, and very oblique pale purple-brown stripe beyond the middle arises near the dorsal margin and is there broadest, but tapers off to a point at the apex of the wing; discal spot cloudy brown; cilia whitish-yellow. Hind wings elongated and large, rounded or a little squared behind, silky yellowish-white, without markings, or with only a faint suggestion of an oblique cloudy stripe; cilia

concolorous. Antennæ of the female simple, body much stouter; fore wings rather narrower, a little more dusted with yellow-brown, and often with the oblique stripe less distinct; otherwise similar.

Underside of the fore wings pale yellow with a large smoky cloud from the base to the middle, and the oblique stripe smoky-black; dorsal region silky-white. Hind wings pale yellow dusted with brown; central spot brown, and beyond it a short oblique partial yellow-brown stripe; dorsal margin yellowish-white. Body yellow; legs purplish-brown.

Slightly variable in the depth of the colour of the fore wings and in the distinctness of the oblique stripe, and also in the presence or absence of a faint stripe on the hind wings. A male specimen in the collection of Mr. Sydney Webb is devoid of the oblique stripe of the fore wings, another has no discal spot; a female has the oblique stripe most conspicuously darkened and spread outwardly so as to extend almost along the hind margin, while others have the brownish dusting very much intensified.

On the wing in July and August.

LARVA rather slender, cylindrical, stoutest at the tenth segment, thence tapering almost imperceptibly to the head, which is flattened and narrowed a little in front; anal flap ending in two short points, whilst from under it projects a pair of longer and more slender points, slightly curved inwards and projecting quite one-sixteenth of an inch; skin smooth but transversely wrinkled on the hinder part of each segment and along the spiracles; when handled it feels tough and stiff. Ground colour pale greyish-ochreous, with a pinkish tinge along the sides; down the back is a broad paler stripe having a rather dark brown line down its middle, most distinct on the front segments, and edged with a fine brown line; a broad pale greyish-buff subdorsal stripe, beginning on the head and continued to the extremity of the

anal points, is bordered above by a fine brown line; next a broad lateral stripe sprinkled closely with brown freckles, and bearing two fine pale lines, the lower of which is whitish throughout the last four segments, and in the hinder part of each of the others; then the pale puffed spiracular ridge bearing reddish-yellow spiracles ringed with brown; under the ridge, just beneath each spiracle, is a longitudinal dark brown dash; undersurface greyish-ochreous with two faint dusky lines; the usual dots wide apart, blackish in colour; the lateral stripe ceases on the front of the thirteenth segment, leaving the anal flap and the long points pale. The difficulty in this description is to speak of these lines and markings with sufficient clearness, and at the same time not to give too strong an idea of them. (Rev. J. Hellins.)

September till June or July, hibernating when rather small; on *Thymus serpyllum*, *Achillea millefolium*, *Potentilla reptans*, *Medicago lupulina*, *Veronica serpyllifolia*, *Polygonum aviculare*, and probably many other herbaceous plants. Hofmann adds *Onobrychis*, *Hippocrepis*, *Cytisus*, *Hypericum* and *Teucrium*. It has the same curious habit as the last species, of coiling itself, when alarmed, so as to look like a faded snail shell; when undisturbed it remains stretched out at full length upon its food-plant; but when induced to coil it will allow itself to be rolled about like a wheel.

PUPA long and slender; head, wing-cases and anal segment shining dark brown, rest of the abdomen rather pale red-brown, with spots and transverse streaks of dark brown. (Rev. J. Hellins.) In any small interstice between bits of earth, sticks or stones, in a cocoon of a few threads of silk.

An exceedingly local species in this country, and usually confined to chalk downs and rough fields on the chalk. In such situations locally plentiful in Kent, at Dover, Deal, Walmer, Folkestone, Rochester, and elsewhere; also on the chalk hills of Surrey about Reigate and Leatherhead. It is

recorded as occurring near Harrow, in Middlesex, by Messrs. Bonhote and Rothschild; and in Devon by Mr. Parfitt. There are also records in Somerset and Gloucestershire. Formerly abundant in Suffolk, especially in clover-fields about Tuddenham, but said to be far less common. Indeed, there are indications that this is a species which is slowly disappearing in this country. I have no notice of its occurrence in Wales or Scotland, but in Ireland there are records for Howth, near Dublin, Powerscourt, Wicklow, Galway, and Magilligan, Derry, but only of rare or solitary specimens. This is not easily accounted for.

Abroad the insect is found in Eastern Europe, Northern Italy, Central and Southern Germany, Switzerland, Hungary, Southern and Eastern Russia, Turkey, Persia, Armenia, Tartary, and the mountain regions of Central Asia.

#### Genus 18. **EURYMENE.**

Antennæ of the male shortly pectinated; palpi small; head somewhat smooth; thorax rather thick, fluffy with raised scales; abdomen short and smooth, curled up; fore wings squared at the apex, hollowed above the anal angle; hind wings short and broad, hollowed at the anal angle.

We have only one species.

1. **E. dolobraria**, *L.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{8}$  inch. Fore wings truncate and deeply hollowed at the anal angle, before which is a purple cloud; otherwise yellowish-brown with abundant transverse purple lines; hind wings yellow-white, with a similar cloud. All the wings have a scorched appearance.

Antennæ of the male pectinated to four-fifths of their length, with solid ciliated teeth, the remainder simple but notched, brown; palpi minute, head very smooth, both dark purple-brown, as is a ridge at the back of the head, and also

the collar; remainder of thorax pale yellow-brown, shoulder-lappets furnished with long loose scales; abdomen smooth, curled up in some degree behind, yellow-brown, hinder segments tinged with purple; lateral tufts inconspicuous; anal tuft dark purple. Fore wings truncate and of very unusual shape; costa much arched; apex rectangular; hind margin below it straight and nearly perpendicular to the middle, then curved in and deeply excavated to the anal angle, which is defined and rather sharp; dorsal margin straight; colour soft silvery yellowish-brown, almost yellowish-white, much obscured by abundant perpendicular slender tawny or purple-brown streaks; usual markings almost absent, but the second line is suggested by a curved and shaded massing of the tawny streaks, which there are intensified, becoming chocolate-red on the dorsal margin; beyond this the whole area near the anal angle is tinged and clouded with glossy purple; a small cloud of this colour also lies at the base of the costa; cilia extremely short, yellow-brown. Hind wings rather extended and rounded at the apex and adjacent portion of the hind margin, but decidedly hollowed toward the anal angle; silky whitish-yellow shading into pale golden-brown at the apex and hind margin, except the excavated portion, the space above which is broadly dark purple, barred several times with cloudy-black. Female very similar, rather larger and having simple antennæ.

Underside of the fore wings rich golden-yellow, shading to white on the dorsal margin and to purple at the base and anal angle; the yellow surface softly barred by perpendicular pale purple lines. Hind wings from the base to the middle yellowish-white, transversely streaked and spotted with yellow-brown; along the hind margin is a very broad purple band edged inwardly with golden-yellow, and mottled with the same. Body dull purple; legs yellow shaded with purple.

Hardly variable, except a little in depth of colour and distinctness of the transverse purple-brown streaks.



On the wing at the end of May and in June. We seem to have no record of the appearance here of specimens of a second generation, though such an occurrence is usual on the Continent.

LARVA twig-like, the third segment having a considerable dorsal and lateral enlargement, and the second being swollen, both being much wrinkled; ninth also swollen and humped; anal segment bristly and furnished with two small points; head rounded and slightly bifid, purple mottled with white; body yellowish-, greenish-, or pale reddish-brown, mottled with hazel and purple-brown; from the second to the fourth segment the back is dark purple; hump on the ninth segment purple, and a purple transverse bar on the twelfth; spots grey; spiracles black; a pair of small raised black ventral spots each on the fifth, sixth, and seventh segments, and sometimes on the eighth and ninth; there are faint traces of paler dorsal and spiracular stripes. (C. Fenn.) The Rev. P. H. Jennings, in an old number of the *Entomologist*, pointed out that "when at rest, with the mouth tightly pressed to the legs, the first three segments much resemble a miniature dog's head, the head of the larva representing the dog's nose, and the protuberances of the third segment the ears and crown of the animal's head." *This* cannot well be included among *protective* resemblances! but the creature is sufficiently provided for in that respect by its extraordinary likeness to an oak-twig.

July, August, and September on oak, saw, beech, and birch. This larva is very much more frequently captured than the moth.

PUPA rather slender, and very gently and regularly tapering off behind; eyes and front of the head rather prominent; wing-covers rough with abundant fine sculpture or cross-wrinkling; limb and antenna-covers more distinctly cross-barred with incised lines; dorsal and abdominal segments faintly dotted with minute pitting, except those nearest the

extremity, which are smooth, as also is a band at the hinder edge of the rest; general surface only moderately glossy; colour red-brown, the wing- and limb-covers and incisions of the segments darker; cremaster thick at the base, and very rugose beneath, tapering to a point, on which is a fine spike attended by a few minute curled bristles. In a strong silken cocoon between drawn-together leaves, in crevices of bark, or under moss. In this condition through the winter.

The moth has a curious method of sitting during the day-time; its fore wings are so thrown back as to cover the hind, but both are raised, not erect, but a little above the level, the dark purplish-brown abdomen curled up and exactly fitting between the purple-brown blotches near the anal angles, and thus simulating in an extraordinary manner a crumpled brown leaf. It sits thus among leaves in bushes and the branches of trees, and clings tightly so as not to be readily beaten out, or if disturbed drops almost instantly to another branch. If aroused it will fly swiftly away. Its natural flight is at night, and it is attracted by a strong light, and also by the sugar daubed upon trees to attract *Noctua*. But it is seldom seen in the moth state, most of the specimens in collections having been reared from larvæ obtained by use of the beating-stick. Principally found in or near woods, yet not confined to them; never very common, but it appears to have been obtained in almost every county in England, though rarely in the North—apparently once only in Northumberland and once in Durham. Probably generally distributed in Wales, since it is recorded from the north of that Principality, and from Glamorganshire, Carmarthenshire, and Pembrokeshire in the south. In Scotland, Mr. W. Grant Guthrie has taken a specimen at Goldielands, near Hawick; and there is a single record at Dumfries. In Ireland, casual specimens have been met with near Dublin, in Kerry, Galway, Sligo, Westmeath, Monaghan, and Fermanagh. Abroad it has a considerable range through Central Europe, the tem-

perate portions of Northern Europe, Northern Italy, Sicily, Bulgaria, Southern Russia, and Japan. Probably also over some portions of Central Asia.

### Genus 19. ODONTOPTERA.

Antennæ of the male shortly pectinated; palpi small; head rough; thorax thick, very fluffy with raised soft scales; abdomen moderately stout, smooth, short. Fore wings large, pointed, hind margin provided with numerous long points and rounded hollows; hind wings crenulated.

We have only one species.

1. **O. bidentata**, L.—Expanse  $1\frac{5}{8}$  to  $1\frac{7}{8}$  inch. Wings ample, scalloped behind, and the fore wings there running out into several tooth-like projections; colour of all the wings pale yellowish-brown or olive-brown; the discal spot and two transverse lines of the fore wings edged with black.

Antennæ of the male pectinated with short, thick, blunt, and densely ciliated teeth nearly to the apex. light brown; palpi slender, dark brown; head and thorax rough, and the latter fluffy with abundance of long soft raised scales, pale brown; abdomen of the same colour, thick, smooth, and rather glossy; lateral tufts rather large; anal tuft small. Fore wings ample; costa scarcely arched; apex very acute; hind margin conspicuously toothed and crenulated behind, the nervures all running out into points and the spaces concave between, but the strongest projections being at the tips of veins four and six; anal angle blunt; dorsal margin a little rounded; texture rather silky; colour drab-brown, olive-brown, or yellow-brown, faintly dusted with umbreous; first line erect, but sinuous and throwing out an angle upon the median nervure, dull black; second line oblique, tolerably direct, but indented at every nervure, dull black, each indentation emphasised by a white dot, that upon the costal margin rather the largest; discal spot of the ground colour,

ovate, edged distinctly with black; cilia of the ground colour, tipped with white. Hind wings elongated toward the apex, rather shortened behind; the margin strongly crenulated; pale brownish-drab; central spot a black ring, followed by a rather sinuous central cloudy black line, not curved, but directly crossing the wing, and sometimes partially duplicated; extreme hind margin and cilia rather paler brown, the latter tipped with white. Female a little paler, dusted with dark brown, body much thicker, antennæ simple.

Underside of all the wings shining, very pale brownish-drab; costa dusted with black; central spot in each a black ring, and beyond it is a slender cloudy black transverse stripe. Body and legs pale brown.

Subject to local and climatal variation. In the North of England, and even in the Midland hill districts, there is much darkening of the ground colour, or it is dusted with dark scales, the transverse lines becoming more strongly marked, and both of them often edged with white dots; in some of these the middle portion of the wing is darkened so as to form a central band. In Scotland this darkening often takes the form of abundant dark dusting; or the lines are strongly marked in spots on a brown ground; while in Ireland a tendency is noticed to special darkening of the area outside the second line, as is seen in *Ennomos fuscantaria*; others from this country have ferruginous tints; others again have a darkening of the middle of the median nervure, which unites the first and second lines; and a specimen in the collection of the Rev. John Bristowe at Belfast has very black transverse lines upon a *pale* ground colour. Specimens from Durham are often beautifully clouded with grey; others from South Yorkshire with dark brown and black; some of those from Northumberland with dark ground colour and black lines have a *paler* central band; and Mr. G. T. Porritt has one quite smoothly black-brown, with scarcely a trace of lines or markings. From the Lancashire mosses a form has

recently been obtained of a smooth smoky-black, without markings, except that the nervures are deep black. In another variety of somewhat uncertain occurrence the first and second lines are *white* in a dark olive-brown ground colour. In the collection of Mr. Frank Norgate is a specimen, obtained at Aberdeen, which has a black stripe across the *hind* wings, and the two lines of the fore wings blackened and almost meeting; one in Mr. W. H. B. Fletcher's collection, in which these two lines are white, has them drawn so nearly together that they lie parallel from the middle to the dorsal margin, enclosing only a narrow strip of central band; another in the same collection has them joined in the middle of the wings, and there abbreviated, so that the specimen has no central band, but instead a large costal blotch. A very curious specimen, reared at Reading by Mrs. Bazett, has large portions of the fore wings almost diaphanous from absence of scales, and the middle of the hind wings similarly denuded, yet the cilia are perfect.

On the wing in May and June; occasionally at the end of April.

LARVA twig-like, moderately stout, slightly enlarged behind; there is a slight eminence, with two small points sloping backwards, on the twelfth segment; dorsal spots slightly raised; head large, bifid, dull purple; face vertically flattened, its lower portion ochreous; anal extremity furnished with three points; body with a few scattered short hairs; colour dull purple, faintly clouded with ochreous and brown, frequently having two orange dorsal dashes on the fourth, and two on the ninth segment; eminence on the twelfth segment edged with black; anal points whitish beneath; undersurface between the prolegs paler.

Or—ochreous, mottled and clouded with brown and purple, especially so on the ninth and thirteenth segments; dorsal line purplish, narrowly margined with black, but interrupted between the second and fourth segments; on the latter is a



purple triangular mark ; subdorsal and spiracular lines threadlike, blackish ; dorsal spots slightly raised, black, those on the ninth and tenth segments velvety-black ; head dark brown, lower part of the face whitish-ochreous.

Or—from Scotland—very pale whitish-ochreous—nearly white—with a greenish tinge, vividly marbled with dark brown and black ; an irregular series of black-edged dorsal diamonds is continued on the sides ; there is a black spot on the back of the third, fourth, tenth, eleventh, and twelfth segments ; usual dorsal dots slightly raised ; on the twelfth segment is a horseshoe-shaped projection edged behind with dark brown ; fifth, seventh, and ninth segments much clouded with dark rust colour ; head greyish-ochreous, its upper half black ; anal segment brownish-grey.

Or—also from Scotland—purplish-brown, marbled with darker ; on the back is a series of ill-defined pale diamond-shaped markings ; two brown spots upon the fifth segment ; the hump on the twelfth segment is edged with black ; and the ninth is clouded with dark brown. (C. Fenn.)

Another form is pale green with abundant irregular black, or black-yellow, spots and streaks formed so as precisely to resemble small lichens growing upon a bit of stick. Another is greenish-grey with somewhat similar markings ; and intermediates between all these forms occur.

July to September, or even October, on birch, oak, hawthorn, hazel, sallow, willow, blackthorn, plum, beech, whortleberry, broom, and even on larch, juniper, and tree-lichens ; feeding at night and arriving very slowly at full growth.

PUPA moderately stout, thickest in the middle, the limb-covers not strongly expressed, dull, hardly sculptured, but roughened by excessively numerous minute depressions ; wing-covers simply roughened, but having the nervures of the wings indicated ; segments more glossy but almost covered with minute pitting except the usual smooth hinder band of each ; the whole mahogany-red, a little darkened on the

wing-covers, but anal extremity and cremaster extremely glossy, the former thickened, the latter blackened, short and conical, provided with a pair of hooked spines and a cluster of minute curled bristles. In a tough silken cocoon under moss or dead leaves, or just beneath the soil, often at the foot of a tree.

In this condition through the winter.

The moth usually sits, during the day, near the ground, on the trunk of a tree, or a fence, or especially among low bushes and herbage, looking quite like a withered leaf; if old fir-trees are at hand it will ensconce itself under one of the projecting pieces of rough bark, sitting so that only the ends of its wings are visible, and these bear so accurate a resemblance to the flakes of loose bark which fall from these trees that it is almost perfectly protected. As it sits the wings are deflected, and not raised as in some of the allied species. It is very sluggish in the daytime, and can then scarcely be induced to fly, but may be most easily picked up in the fingers, and handled without being greatly disturbed. Moderately common throughout England, perhaps least so in the Eastern Counties, but preferring wooded districts; nevertheless, it may often be found in hedge-rows, or on isolated trees, even in gardens. It is tolerably frequent throughout Wales and Ireland. Fairly common also in Scotland, plentiful in Perthshire and some other wooded districts, extending to Moray and Sutherlandshire, and to the Hebrides, but apparently absent from the Orkneys and Shetland Isles. Abroad it is found throughout Central Europe and the temperate portions of Northern Europe, Northern Italy, Southern Russia, Eastern Siberia, and the mountainous regions of Central Asia.

#### Genus 20. **ENNOMOS.**

Antennæ of the male pectinated; palpi short, shaggy, head rough; thorax robust and covered with fluffy soft raised

scales; abdomen moderately stout, very so in the female; fore wings pointed, the hind margin angulated about the middle, otherwise crenulated; hind wings broad, hind margin crenulated and having one projecting point.

LARVÆ closely resembling twigs of trees.

PUPÆ usually in open network between leaves.

The species are closely allied, yet may readily be distinguished.

A. Fore and hind wings with numerous projecting teeth; size over two inches. *E. autumnaria.*

A<sup>2</sup>. Wings with one angle or tooth prominent, hollowed beneath; size under two inches.

B. First line angulated on the subcostal nervure.

*E. angularia.*

B<sup>2</sup>. First line smoothly curved.

C. Second line also gently curved; thorax canary-yellow.

*E. alniaria.*

C<sup>2</sup>. Second line continued outwardly along the costa; thorax pale fulvous.

*E. erosaria.*

C<sup>3</sup>. Second line approaching the first on the dorsal margin; space beyond it fuscous.

*E. fuscantaria.*

1. **E. autumnaria**, *Wernb.*; **alniaria**, *L.*—Expanse 2 to 2 $\frac{1}{4}$  inches. Hind margin of fore wings conspicuously toothed, of the hind wings scalloped and crenulated; all the wings pale ochreous shading to red-orange behind, abundantly dusted with purple, and having dull purple transverse lines to the fore wings.

Antennæ of the male pectinated with oblique solid ciliated teeth, of which the rows are placed near together, pale yellow, the shaft white; palpi projecting, pointed, tufted, yellow-orange; head rough and, with the collar, reddish-yellow; thorax very fluffy, the raised scales loosely spreading, reddish-yellow shading off to pale ochreous or even straw colour;

abdomen moderately stout, smooth, orange-yellow, the lateral tufts deeper in colour; anal tuft small, pale ochreous. Fore wings angulated and much crenulated behind; costa nearly straight, but suddenly arched close to the apex, which is pointed and slightly drooping; hind margin hollowed below it, then filled out to a large angular projection above the middle, again hollowed more deeply below, and both hollows arranged in smaller projections or crenulations; dorsal margin decidedly curved and abundantly edged with soft long cilia; colour pale ochreous, orange-yellow, or else whitish-ochreous, shading towards the apex into rich fulvous or orange-red, and in a less degree so towards the hind margin, the whole surface more or less dotted, or spotted, with dull purple-brown; first line, when visible, forming a full curve from the costa to the dorsal margin near the base; second line extremely oblique but curved rather more upwards beyond the middle and then again outward, attaining the costa at a short distance from the apex, both dull purple or purplish-brown; discal spot of the same colour, but cloudy and indistinct, sometimes almost lost among the purplish dots; cilia dark purple-brown dotted with white. Hind wings broad and ample, rounded at the apex and anal angle, crenulated behind, and having a more distinct angulated projection in the middle of the hind margin, those on each side gradually diminishing in size; colour pale ochreous or orange-yellow agreeing with that of the fore wings; obscurely dusted with dull purple or purplish-brown, and having a faint similar narrow transverse stripe before the middle; cilia dark purple-brown on each marginal projection, bright white on each intermediate hollow. Female much stouter, and often rather larger, but with simple antennæ; otherwise similar.

Underside of the fore wings of the colour of the upper but much less spotted; discal spot rather triangular, purple-brown; beyond it is a partial transverse stripe of the same colour from the costa; remainder of the apical area fulvous tinged with purple. Hind wings pale ochreous or orange-

yellow, clouded all over with purple, dusted with dark purple-brown; and having the central spot and a broad transverse stripe, *preceding* it, of the same colour.

Variable in the ground colour, from rich fulvous to straw-colour, and very so in the degree of purple spotting or dusting, which sometimes is almost absent; also in the distinctness of the transverse lines, which in pale specimens are, the first more particularly, sometimes almost obliterated.

On the wing in August, September, and even the beginning of October.

LARVA  $2\frac{1}{2}$  inches long, slender in proportion, thickest behind and tapering slightly smaller to the head; on the back of the seventh segment is a transverse prominence, and on the eleventh another, smaller; the third pair of legs is long and strongly hooked, and the two pairs of prolegs robust, long, and strongly stem-clasping; above these, on the back of the thirteenth segment, are two raised points; the incisions of the segments are marked by wrinkles and small humps; general colour dark brown or umbreous, irregularly mottled and streaked with rather redder-brown, so that the resemblance to a bit of brown stick is most extraordinary, the first and second pairs of legs being drawn close to the head, as it poises itself at rest, while the third pair sticks out straight like a short thorn. Head much flattened, reddish-brown; the mouth darker; antennal papillæ conspicuous, pointing forward; the redder colour lies in longitudinal stripes upon the browner colouring of the anterior segments, and in much more broken-up streaks on the segmental divisions; the hindmost segments are the roughest and the darkest in colour; undersurface quite as rounded as the rest of the body and of the same colour and appearance. (From larvæ furnished by Mr. G. T. Porritt.)

May to August on birch, willow, alder, hawthorn, blackthorn, maple, and plum, and probably other trees. Mr. Sydney Webb found it at Dover spun up between leaves of



*sycamore*, on which it had probably fed. Feeds principally at night; by day remains in the stiffly straight position of a large twig.

PUPA large and stout, holding its abdomen almost constantly bent or curved; colour green, with a superficial coating of white or pinkish-white sculpture in relief, which under a lens appears like most beautiful working, in porcelain-like material, placed in irregular and cross lines over the front of the thorax, indicating the joints of the limbs and pectinations of the antennæ; also in thick wrinkles between the nervures on the wing-covers; and as irregular raised margins of the small pitting on the broad bands of the abdominal segments. Although rather coarse this sculpture looks to the unassisted eye much like a powdery bloom or dusting. Segmental folds smooth, green, edged with pink; spiracles black-brown; some scattered black dots lie along the edges of the segmental bands; cremaster deeply wrinkled, elongated, pale pinkish-brown, armed toward the tip with some hooked black spikes which hold firmly to the inside of its cocoon. The latter is extremely slight—a mere network of white silk threads drawing together leaves, but with interstices through which the pupa is distinctly visible.

The winter is passed in the egg-state.

In all probability the moth passes the day hanging to a twig in some tree, but very little is known of its habits here, except that both sexes are strongly attracted at night by light, and are usually captured—if at all—at street-lamps. So far as these Islands are concerned, it seems to be confined to the coast of the South of England and almost to the extreme *South Coast*. Whether it is a frequent immigrant, or that it is only able to exist in a climate little affected by frost, is not yet clearly established. So far as can be ascertained, the first specimen noticed here was taken at the North Foreland, Kent, before the year 1855; but in that year the capture of two more was announced, one in September, at

light, outside the Sussex County Hospital at Brighton, by Mr. J. W. Winter; the other at Margate. Several years seem to have elapsed without any addition to the number, but in 1862 another was secured at the Hospital at Brighton, and a female was obtained at Deal. In September 1865 two were taken at Gosport, Hants, and from eggs laid by one of these, larvæ were reared the next year; another was captured in 1867 at Deal. Several years again elapsed, but in 1877 three were taken at light at Alverstoke, Hants, and in 1879 about a dozen at Gosport. In 1880 a female captured at a gas-lamp at Deal laid eggs, from which, in August of the following year, a number of very fine examples were reared by the late Mr. Tugwell, and to his skill and success in continuing the breed I, among many others, am indebted for a very fine series. Others were captured in following years at Deal, Folkestone, Dover, Hythe, Chichester, and Margate, in 1897 a larva at Walmer, in Kent. and in 1898 the moth was recorded as taken at Shoeburyness, Essex. Thus it seems to have been captured at large in Kent, Sussex, Hants, and Essex, and there is a single unconfirmed record in Cornwall. But the vast majority of specimens in collections here are the result of continuous rearing from the egg.

Abroad it is found throughout Central Europe and much of the temperate portion of Northern Europe, Northern Italy, the Ural Mountain district, Tartary, and Japan; also in Canada, Nova Scotia, and some other parts of North America.

2. **E. alniaria**, *L.*; **tiliaria**, *Stn.*—Expanse  $1\frac{1}{2}$  to  $1\frac{5}{8}$  inch. Head and thorax light canary-yellow; fore wings pointed, conspicuously angulated above the middle of the hind margin, orange-ochreous, with two well-curved transverse lines; hind wings scalloped behind and with a projecting central point.

Antennæ of the male pectinated with solid curved ciliated teeth, the rows lying near together, pale ochreous; palpi

projecting, pale purple-brown ; head roughly tufted, canary-yellow ; thorax very thickly covered with long fluffy raised scales, bright canary-yellow ; abdomen moderately stout, smooth, pale ochreous, the basal portion covered with long yellow scales ; lateral tufts very small ; anal tuft short. Fore wings pointed ; costa very straight to near the apex, where it is a little arched ; apex sharply pointed ; hind margin beneath it faintly hollowed, but filled out above the middle into a blunt projection, below which is a considerable hollow, whence it is rounded off, sweeping in a full curve round the anal angle ; both above and below the projection a small point or crenulation terminates every nervure ; dorsal margin gently rounded and moderately ciliated ; colour ochreous-yellow or orange-yellow, faintly dusted with purplish-black ; first and second lines pale leaden-brown, both oblique, and both curved in a similar manner, though not quite parallel ; discal spot a rather oblique leaden streak ; costa clouded or dusted with leaden-brown ; cilia whitish-ochreous, spotted upon every crenulation with brown-black. Hind wings broad and rounded behind, but finely scalloped and crenulated, the middle joint projecting beyond the rest ; pale ochreous, deepening to fulvous along the hind margin ; in the middle is a faint indication of a transverse leaden line ; cilia white, with the tips of the crenulations black-brown. Female stouter, antennæ simple, otherwise similar.

Underside of all the wings dull orange-yellow ; the markings of the upper side reproduced ; the costa and apex of the fore wings and the whole of the hind wings dusted with dull purple dots, except a yellow stripe down the dorsal margin ; central spot of the hind wings a dusky-black crescent, placed upon the transverse line. Body and legs orange-yellow dusted with purple ; leg-tufts canary-yellow.

Chiefly variable in the extent and abundance, or absence, of the purplish-black, or leaden, dusting upon the fore wings, and of the cloudy transverse line or stripe of the hind wings. Mr. Sydney Webb has a specimen in which the dusting is so

much intensified as greatly to darken the colour of the fore wings with smoky clouding, and even to extend to the thorax. In Mr. W. H. B. Fletcher's collection is a male in which the first and second lines do not cross the wings, but are united in the middle so as to form a large loop or blunt triangle from the costa.

On the wing in August, September, and the beginning of October.

LARVA elongate, twig-like ; skin shining ; slightly tapering forwards ; having a large dorsal hump and lateral enlargements on the sixth segment, a small transverse dorsal prominence on the ninth, and two small points on the twelfth ; also four ventral warts in a transverse line on the seventh, and three anal points ; sides puckered ; third pair of legs placed on a fleshy cushion ; head rounded and flattened, dull brown, paler than the ground colour, which is dark hazel-brown, mottled and shaded with purplish-brown ; undersurface paler, with a greenish tinge, the portion between the prolegs whitish ; protuberances tipped with ochreous ; there are faint traces of ochreous subdorsal lines on the anterior segments. (C. Fenn.)

May to July on alder, birch, and willow ; feeding at night ; remaining during the day at rest in the position of a twig of its food-tree.

PUPA stout, thoracic portion nearly cylindrical, the abdominal segments very smoothly tapering off ; top of the head-cover strongly ridged ; surface devoid of gloss ; greyish-ochreous or yellowish-ochreous, reticulated and dusted with dark brown ; the wing- and limb-covers whitened with a shelly superficial coating which is cut up in all directions by fine incised lines, and has a curious appearance ; that portion covering the antennæ being, however, beautifully sculptured with the joints and pectinations thereof ; segments very much roughened superficially with fine wrinkles, but a band at the hinder margin of each is quite smooth ; cremaster extraordi-

narily wrinkled, apparently furnished with a tuft of hooked bristles, which are thrust so firmly into the silk of its cocoon that they are not easy to examine. In a loose but tough silken cocoon among fallen leaves or moss, on the ground, or among blades of grass growing in the corners of tree-roots.

The winter is passed in the egg-state.

The moth sits by day in thick bushes of alder or birch, its wings raised but not perpendicular, and its general appearance that of a yellow withered leaf. At late dusk it flies, and is strongly attracted at night by a light, so as sometimes even to fly to a lantern in the hand, or it will then show great excitement, dashing wildly about among the trees. Its favourite haunts are marshy places where alder is plentiful, but it is generally distributed about the outskirts of woods and over country districts where trees abound, being still to be taken occasionally in the outskirts of London, attracted by the gas-lamps; formerly it was almost common in the suburbs. Never abundant, but moderately common in the Eastern Counties, and almost throughout England in suitable places, though as yet I find no record in Cornwall, and those which exist for the North show it to be extremely scarce in Northumberland and Cumberland. In Wales it is found in Glamorganshire, Carmarthenshire, and Pembrokeshire, and cannot well be quite absent from the more northern portions; indeed, Lord Boston has found it in Anglesey. In Scotland, rare in Roxburghshire, Ayrshire, Argyleshire, Inverness, and Moray, and once taken near Hawick. Rather local in Ireland, but has been obtained in Wicklow, Waterford, Kildare, Westmeath, and Fermanagh, so probably occurs rarely in other districts. Abroad it is found throughout Central Europe, Northern Italy, and Livonia; and in Sweden.

3. **E. fuscantaria**, *Haw.*—Expanse  $1\frac{3}{8}$  to  $1\frac{3}{4}$  inch. Fore wings with a very square projection at the hind margin; hind wings with a projection like a very short tail; thorax and all



the wings pale brownish-ochreous; beyond the second line of the fore wings the surface is pale fuscous.

Antennæ of the male pectinated with solid curved ciliated teeth, yellow-brown; palpi porrected, pointed, red-brown; head densely tufted, yellow-brown or pale ochreous; collar similar; remainder of the thorax very loosely but densely covered with long raised brownish-ochreous scales; abdomen moderately stout, smooth, similar in colour; lateral tufts minute; anal tuft golden-brown. Fore wings rather narrow; costa almost straight; apex squarely angulated; hind margin beneath it perpendicular to a squared projecting angle above the middle, under this is a distinct deep hollow, and then the usual rounding off, with faint crenulations, to the anal angle; dorsal margin a little rounded and ciliated; colour dull ochreous, shading to greyish-ochreous or fuscous; first line oblique and slightly curved; second very much more oblique, long, and scarcely curved till near the dorsal margin, where it approaches the first line, both grey-brown; the whole hind-marginal space beyond it evenly suffused with fuscous or grey-brown, which is darkest at the extreme margin; discal spot very obscure—a faint cloudy yellow-brown streak; cilia tawny, and often faint lines of that colour run inwards along the nervures. Hind wings broad and rounded, faintly crenulated behind, and having in the middle of the hind margin a more decided projecting tooth; colour dull ochreous, much covered with long pale yellow hair-scales, shading off to tawny along the hind margin, and especially upon the cilia. Female decidedly larger, and much stouter, with simple antennæ; otherwise similar.

Underside of the fore wings dull yellowish-ochreous, shading to yellowish-white on the dorsal margin; but all the costal and hind-marginal regions strongly tinged with smoky-brown; second line faintly indicated; discal spot distinct as an erect cloudy black streak. Hind wings dull uniform smoky purple-brown, the cross-bar faintly red-brown. Body and leg-tufts purple-brown; legs pale yellow-brown.

The shape of the second line of the fore wings is not always reliable; in occasional specimens it is bent inwards, a little, in the middle. There is considerable variation in the extent of fuscous or grey-brown shading, which occasionally does not fill the hind-marginal space quite to the dorsal margin, more frequently extends itself either along the dorsal margin or the costa, and invades the paler area; Mr. R. Adkin has a specimen in which it extends over the whole of the fore wings; while Mr. Sydney Webb has a bright, light-coloured male in which it is absent from the usual hinder area, or only suggested by a faint pale purplish-brown shade; in this specimen the hind wings are of an unusually rich colour—almost chestnut—towards the hind margin.

On the wing in August and September.

LARVA elongate, twig-like, tapering toward the head, which is small and flattened; third segment swollen laterally; sixth and seventh segments each with a small lateral protuberance; sixth and ninth provided with small transverse dorsal humps; two ventral warts also upon the seventh segment, and upon the anal two minute and separate points; sides puckered; colour pale brownish-green; humps and protuberances tipped with dark reddish-brown; spiracular stripe ill-defined, pale yellow; head pale green; legs brown.

Or—Elongate, attenuated in front; no lateral or dorsal humps, or protuberances, except the two ventral warts on the seventh segment and the two anal points—sometimes even devoid of the ventral warts—colour pea-green, sides darker; spiracular stripe broad, yellow, but ill-defined; ventral warts, when present, tipped with ochreous and shaded with red-brown; head pale green; legs reddish-brown; prolegs tinged with dull purple. (C. Fenn.)

Another variety, reared by the late Rev. John Hellins, and figured by Mr. Buckler, was reddish-grey, slightly mottled with green; spiracular stripe rather greener than the ground

colour, becoming more yellow from the second segment to the mouth ; across the third segment was a row of red-brown warts, the largest being on the sides ; on the sixth and ninth segments large transverse red humps, and very small ones on the eighth and twelfth ; lateral red warts on the fifth, sixth, and seventh, and on the latter also a ventral hump ; legs crimson-brown, third pair large.

May or June to the beginning of August ; on ash (*Fraxinus excelsior*), feeding at night, often eating round holes in the leaves, especially when young. The day is spent stretched out stiffly and obliquely from the ash-twigg, and the green smooth variety of the larva bears a most accurate resemblance to the petiole of an ash-leaf. The other forms of larvæ are not quite so much like an ash-twigg, but this falling off from protective resemblance has not apparently, as yet, produced any predominance in the number of the smooth form.

The winter is passed in the egg-state. The eggs in this and the allied species are of a very pretty rectangular form—brick-shaped—and are laid in rows side by side, or in patches of many such short rows.

PUPA rather short, thickest in the middle, a little flattened in front, but the antenna-cases ridged, and very fully sculptured, with the form of the joints and pectinations ; eye- and limb-covers sculptured with curved, or straight, and crossing lines which appear as though a crusted white outer surface had been cut into by all this sculpture to the actual green skin ; the whole body is pale green, but has this whitish superficial crust everywhere except upon the incisions of the abdomen ; the wing-covers show the nervures in the green inner colour, and between them fine incised lines in the white ; abdominal segments broadly and abundantly pitted and sculptured, so that the white crust is shown up almost like fine porcelain ; cremaster elongated, greenish-white, furnished with scattered, divergent, hooked, black-brown bristles, by which it clings tightly to the wall of its cocoon.

This is hardly more than a strong silken network of a few threads, between leaves, either on the tree or among the herbage beneath—indeed, I have seen it very prettily placed in the middle of the flower-head of an umbelliferous plant—and within it the view of the pupa is almost unrestricted.

The moth sits during the day in trees or bushes, with wings half-erected. At night it flies vigorously, and is very strongly attracted by light, both sexes being found, not unfrequently, hanging to the frames of gas-lamps. Still existing in the suburbs of London, though not so commonly as was formerly the case. Nowhere plentiful, but to be found, where ash is common, throughout the southern half of England, except Cornwall and parts of the Midland Counties; in these, however, it occurs in Leicestershire and rarely in Derbyshire, and has once been taken in North Staffordshire; also it is occasionally found in Cheshire, Lancashire, Yorkshire, and Cumberland, and very rarely in Durham and Northumberland; but I find no record in Scotland. In Wales it occurs, though not commonly, in Carmarthenshire and Pembrokeshire, and therefore may probably be more widely distributed. In Ireland I find no satisfactory record. Its range abroad is very limited, but includes Northern France, Holland, and Silesia.

4. *E. erosaria*, *Schiff.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inch. Fore and hind wings each with a strong angular projection behind, soft pale ochreous or reddish-yellow; fore wings having two oblique, somewhat curved, brown transverse lines, of which the second is rather produced outwardly on the costa.

Antennæ of the male pectinated with solid curved ciliated teeth, glossy yellow; palpi rather porrected, tawny yellow; head and front of the collar bright yellow or reddish-yellow; remainder of the thorax straw-colour, very fluffy with long soft scales; abdomen not very stout, smooth, pale yellow; lateral tufts minute, anal tuft small. Fore wings moderately broad; costa nearly straight, or most faintly arched; apex

sharply angulated; hind margin beneath it rather perpendicular, to a strong blunt angle or tooth above the middle, immediately beneath which it is deeply concave, but toward the anal angle filled out and smoothly rounded, the whole margin being also minutely crenulated; dorsal margin also a little rounded, and ciliated with long soft scales; colour pale ochreous, straw-colour, or fulvous-yellow; very silky in texture; costal region a little dusted with reddish-brown; first line oblique, rather curved, pale purplish-brown; second line much more oblique and straighter, yet partially curved or sinuous, the extremity which reaches the costa usually thickened or extended outwards in a very small degree, of the same colour; discal spot not indicated; hind margin tinged with fulvous-red; cilia very short, silky pale yellow or whitish-yellow, interrupted with brown at every nervure. Hind wings broad, hind margin distinctly crenulated and scalloped and having in the middle a larger projecting tooth or angle; anal angle rather squared; pale yellow, tinged with pale fulvous down the middle, and more strongly so along the hind margin; in some specimens there are faint traces of a tawny central spot, and of a faint straight transverse line just before it; cilia white, interrupted with tawny brown at the tips of the crenulations. Female a little stouter; antennæ simple; otherwise similar.

Underside of all the wings silky pale yellow, or pale ochreous, finely dusted, the hind margin especially, with fulvous; the fore wings show faintly the two lines, the second distinctly on the costa, and also have a red-brown discal streak or spot; on the hind wings is a central red-brown spot, and above it one fainter on the costal margin. Body pale yellow; legs reddish-yellow.

Not very variable, but the ground colour fluctuates between very pale yellow, smooth soft ochreous-yellow, and bright light fulvous. In rare instances the thorax—which otherwise agrees with the fore wings—is tinged with canary yellow, and in Mr. Sydney Webb's collection is one such



in which the canary colour in some degree shows itself upon the fore wings.

On the wing in August and September.

LARVA conspicuously twig-like, rather elongated and tolerably even in thickness, but the head and second segment slightly narrower; on the body are knob-shaped protuberances on each side of the third and sixth segments, double ones on the sides of the seventh, a transverse ridge or hump on the back of the third, larger ones on the back of the sixth and ninth, small ones on the eighth and tenth, a double one on the twelfth, and on the thirteenth a pair of points directed backward; head light brown, with a white crescent on each lobe and a white transverse line above the mouth; body dull brown, purplish-brown or greenish-brown; the humps red-brown; legs and prolegs similar; undersurface pale greenish-brown. Altogether it has as accurate a resemblance to an oak-twig, as could well be furnished. When very young it is smooth and almost devoid of excrescences.

May to July on oak, and sometimes on beech, birch, and lime; feeding at night; remaining during the day upon the twigs, either stretched out, or arched by the contact of both legs and prolegs with the twig, holding on tightly.

PUPA pale brown, mottled and reticulated with still paler, and exhibiting darker lines at the junctions of the segments, and at the margins of the antenna and wing-cases. (E. Newman.) In a cocoon of an open network of silk among leaves. Mr. Newman says that it is a remarkably active pupa, and that those he had wriggled out of their insecure dwellings on being touched.

The winter is passed in the egg-state.

The moth sits in oak, or sometimes other trees, or bushes, in the daytime, and has much the appearance, from its pale colour and raised crenulated wings, of a withered yellow leaf; at dusk it flies, and is at night readily attracted by a

strong light. No doubt its principal haunts are around and in woods, but it is not at all confined to them, being apparently also attached to oaks in hedgerows and along high roads; and it is occasionally found even in fens. Never very common, but found in moderate numbers, or casually, throughout the South of England, and more frequently in the great woods such as the New Forest; also in the Eastern and Western Counties—except that I have no record from Cornwall—and more rarely in the Midlands; noticed in almost every county, to Yorkshire and Lancashire, and Mr. J. E. Robson informs me of the capture of two specimens in Durham. In Wales I find it recorded from near Swansea, and Mr. W. F. H. Blandford met with it near Saundersfoot in Pembrokeshire. In Scotland Dr. Buchanan White gave its range as in the districts of “Tweed, Tay, and Solway,” that is to say, the extreme South of Scotland and Perthshire, but I know of no recent captures in that country. In Ireland it is very rare, but is recorded as having occurred at Howth near Dublin, in Cork, Kerry, and Galway. Abroad its range is through Central Europe, South Sweden, Northern Italy, Southern Spain, Livonia, and Southern and Eastern Russia.

5. *E. angularia*, Schiff.; *quercinaria*, Staud. Cat.—Expanse  $1\frac{1}{2}$  to 2 inches. All the wings scalloped or crenulated behind, with a large middle projection; fore wings pale or reddish-ochreous, with two red-brown transverse lines, the first much bent back from the subcostal nervure, the second curved; hind wings pale ochreous. Female paler.

Antennæ of the male pectinated with rather long solid curved ciliated teeth, light fulvous; palpi pointed, porrected, orange-brown; head rough, narrow, pale ochreous with a tawny tinge; thorax moderately broad, loosely covered with long fluffy dull ochreous scales, but the front of the collar and the shoulders tinted with yellow-fulvous; abdomen

smooth, proportionately rather slender, pale ochreous; lateral tufts minute; anal tuft well developed. Fore wings somewhat broad; costa very faintly arched; apex angulated, rather pointed; hind margin distinctly crenulated, also provided with a much larger projection just above the middle, beneath this slightly hollowed but less so than in our other species of the genus; anal angle rather squared; dorsal margin rounded and ciliated with long, soft scales; colour pale fulvous or pale orange-yellow; first line slender, red-brown or dull purple-brown, curved outwardly, and bent back toward the base in a blunt angle at the subcostal nervure; second line placed rather far back, fully curved or sometimes a little sinuous, of the same colour as the first, and strongly marked on the costa; the hind-marginal area beyond this line is commonly clouded from it with some shade of fulvous or tawny-brown; discal spot obscure, purple-brown; cilia also of this colour, but tipped with white between the crenulations. Hind wings broad, rounded, but strongly crenulated behind, the middle point much larger and longer than the rest; colour paler orange-yellow, still paler toward the base; in the middle is a slender obscure transverse purple-brown line; cilia tawny, tipped in the hollows with white. Female much stouter in the abdomen; antennæ simple; crenulations and projections of the wings rather more pronounced; pale straw-yellow or whitish-ochreous, dusted with tawny scales, and sometimes the nervures indicated in the same; hind wings also paler, but the hind margin edged with tawny; markings similar.

Underside of the fore wings dull ochreous, dusted along the costa with tawny, and the apical area nearly filled with the same; discal spot and second line distinct, tawny. Hind wings dull ochreous; central spot red-brown, and before it a slender purplish transverse line; from this to the hind margin clouded nearly all over with pale purple; cilia all tawny. Body and legs reddish-yellow, front tibiæ paler.

Rather liable to variation in the ground colour of the fore wings in both sexes, and also in the degree of dusting upon the surface in the female, and of colouring of the nervures in the middle of the wings, this last extending in some degree to both sexes. More so in the extension of tawny or purple colouring from the second line outwards. This in some specimens forms a narrow ill-defined cloudy stripe, in others a larger cloud more extended in its middle portion, and so in increased degrees, until in occasional examples the whole outer area is clouded with purple or purple-red, the remainder of the wing remaining of the normal colouring. In other cases, with the purple clouding of the outer area as already described, is also an extension *inward*, from the first line, of the same colour—this last variation appearing very decidedly also in the female—and sometimes leaving to the fore wings only a yellow spot at the base and a yellow central band, itself in some degree clouded with purple, the hind also being clouded inward, from the hind margin, with the same colour. Occasionally in these varieties the darker colour is brown, red-brown, or purple-brown; and specimens in several of the best collections have the fore and hind wings wholly dark umbreous or liver-brown, except the cilia, which with the thorax retain the normal colouring, while the transverse lines are dull yellow.

On the wing at the end of August and in September.

LARVA elongate, twig-like, attenuated in front, wrinkled; there are transverse dorsal humps on the sixth and ninth segments, and slight dorsal projections on the fifth, seventh, and twelfth; also lateral prominences on the fifth and seventh; the third and fourth segments are rather swollen laterally, and there are two small points below the anal flap; head flattened, brown; general colour various shades of brown, reddish-brown, yellow-brown, and purple, clouded and mottled with red and olive-brown; an ochreous subdorsal line is visible on the fifth and sixth segments, and two black

dots on the hump of the twelfth; other eminences shaded with brown and tipped with ochreous; undersurface obscurely dotted with brown and tinged with green; space between the prolegs green. In this form it closely resembles an oak-twig. Or—Unicolorous yellowish-green without humps or projections; head paler green. (C. Fenn.)

April to July on lime, elm, oak, birch, hawthorn, and occasionally beech; feeding mainly at night, resting on the twigs by day. When fed in numbers within a gauze bag, on a branch of lime, out of doors, the majority are still of the humped and knotted brown form, but a few smooth and green, like petioles of lime leaves, all being under precisely the same conditions. This I have fully demonstrated in my own garden, but it is somewhat perplexing.

PUPA somewhat like that of a butterfly; moderately cylindrical except that the hinder segments taper off rather rapidly; limb-covers rather close and compact, neatly sculptured in cross incised lines, and the head-cover rather prominent; wing-cases covered with a superficial arrangement of horny substance in which the sculpture of abundant incised irregular lines is embedded; dorsal and abdominal segments covered, except the posterior margin of each, with abundant minute pitting, among which are numerous brown dots; anal segment produced into a long conical cremaster, which is tipped by two short strong hooked spines and several strong curved bristles; greenish-grey or greenish-brown or green, or sometimes the wing-covers are yellow-brown and the body green; cremaster but little darker. In a slight silken cocoon among leaves.

The moth sits during the day with wings half raised, in a tree or bush, on the lower portion of the trunk of a tree, or on one of the small twigs springing from its side, and in all these positions looks like a yellow leaf—so much so, indeed, that it is quite startlingly suddenly to recognise the moth before one's eyes. At night it flies swiftly, but comes



occasionally, though rarely, to a light. It is still an inhabitant of the London suburbs, having taken kindly to the limes with which some of the roads are shaded. Although never seen in abundance, it is a fairly common inhabitant of all the Southern, Eastern, and Western Counties, but is rare in the Midlands, and in Lancashire, Yorkshire, and Cumberland. In Scotland I find records at Dumfries, and at Dunoon, Argyleshire, and am informed by Mr. R. S. Gordon that six specimens were taken at Monteith, in August 1895, by Mr. Maxwell. In Wales it has been taken at Swansea. In Ireland it is recorded from Derry, Sligo, Galway, and Roscommon, and a specimen, which I have seen, was taken many years ago by the Rev. J. Briscoe in the County Down. Abroad its range is through Central Europe, Central and Northern Italy, Corsica, Sweden, Dalmatia, and Livonia.

#### Genus 21. CROCALLIS.

Antennæ of the male stoutly pectinated; palpi slender; head rough; thorax robust, densely covered with long scales; abdomen tapering in the male, thick in the female, smooth; fore wings very broad, hind margin expanded, faintly crenulated but without a middle angle or tooth; hind wings rounded.

We have only one species.

1. *C. elinguaris*, *L.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inch. Fore wings broad, expanded behind, hind wings rounded; both pale ochreous; fore wings furnished with two brown transverse lines which usually enclose a brown band, and in it a black discal spot; hind margins dotted.

Antennæ of the male pectinated with curved solid ciliated teeth, whitish-drab, palpi small, reddish-brown; head rough with raised scales, yellow-drab or pale ochreous; front of the thorax similar, very fluffy, the hinder portion paler; abdomen moderately stout, tapering, smooth, pale buff; lateral tufts hardly perceptible; anal tuft not large. Fore wings broad;

costa very straight; apex squarely angulated; hind margin below it perpendicular, very full and expanded, crenulated, much rounded off toward the anal angle; dorsal margin rather full, softly ciliated; colour pale ochreous or yellow-drab, sometimes minutely dusted with brown; first line nearly straight, perpendicular; second almost erect from the dorsal margin, then curved gently outward and with a bold sweep, again up to the costal margin; both red-brown and usually enclosing a central darker band of some shade of brown, red-brown or yellow-brown, though sometimes of only the ground colour; discal spot large and conspicuous, ovate, brown-black; along the hind margin is a more or less incomplete row of small brown dots; cilia yellow-drab, sometimes tinged with tawny. Hind wings rather broad, rounded behind; pale ochreous, sometimes dusted with red-brown toward the hinder area; central spot small, brown; beyond it is a slender faint transverse red-brown line; hind margin dotted with minute brown spots; cilia pale yellow. Female very similar, but with simple antennæ, and the abdomen large and thick.

Underside of all the wings yellowish-ochreous, dusted with red-brown; but the dorsal margin of the fore wings is silky yellowish-white; the central spot and the succeeding transverse line in each wing is reproduced, red-brown; hind margins dotted with brown; body and legs yellow-ochreous.

There is variation in the colour of the central band of the fore wings, as already indicated, through many shades of umbreous, yellow-brown, and even red-brown, in the darker shades often accompanied by dusting of the same in the area beyond the second line; at the same time the two lines enclosing the band become also darker or paler; but in Mr. S. J. Capper's collection is a fine example of the male in which these two lines are much thickened and very dark, but the contained space is only of the pale ground colour, the stripe on the hind wings being also very dark; another, of a pale fulvous colour, and very silky, has no trace whatever of either line. This last is a Scottish specimen, and

there appears to be in that country a tendency to local variation in this direction; Mr. F. J. Hanbury has a similar specimen with a large discal spot; Mr. Sydney Webb one of a more tawny tint of yellow-brown, the spot small, and the hind wings tinged with orange, but equally devoid of transverse lines. Mr. Webb has also a specimen having the margins of the fore and hind wings strongly shaded with smoky-black; and I possess an example in which the fore wings are wholly tawny-red, the central band a little darker, and the hind wings and the thorax tinged with the same colour.

On the wing in July and August, in very forward seasons as early as the end of June.

LARVA rather stout, attenuated in front; on the twelfth segment is a protuberance of a horseshoe shape; anal prolegs sprawling; head grey-brown, partly withdrawn into the second segment, and with a squared front aspect; variable in colour and markings; ground colour all shades between pale ochreous and dark purplish-grey, conspicuously paler on the back of the second, and frequently of the third, fourth, and fifth segments, while the sides are darker; the horseshoe-shaped protuberance on the twelfth is edged with black. A grey dorsal diamond pattern, commencing at the termination of the pale anterior segments, is distinct in pale, but nearly obsolete in dark specimens, being in the latter almost absorbed in the ground colour; subdorsal lines, when present, pale brown, edged on each side with black; anal extremity tipped beneath with whiter, occasionally forming three white spots. (C. Fenn.)

March to May on hawthorn, hazel, elm, blackthorn, apple, beech, sawtooth, lilac, rose, raspberry, honeysuckle, and probably on almost all deciduous trees and shrubs; feeding at night, resting during the day in a stiff straight position, head downwards and quite rigid, holding on by the prolegs, and having the legs folded closely to the body. Its variations in

colour and markings seem to have relation to those of the twigs of its various food-plants, and the experiments of Professor Poulton (*Trans. Ent. Soc. London*, 1892) show its great sensitiveness to the colour of its surroundings. When resting, and probably feeding, upon lichen it has been found perfectly imitating it in pattern and colour. It has long borne a bad character as a cannibal, but recent observations have greatly tended to show that this habit is not indulged in except when the larva is in straits, for want of moisture, or food in good condition.

The winter is passed in the egg-state.

PUPA elongate, rounded, spiked; antennæ and limbs but faintly indicated; purplish-red, with the abdominal segments paler red. On the surface of the ground, or only slightly covered, enclosed in a loose cocoon of silk and earth. (C. Fenn.)

The moth seems to prefer, in the daytime, to sit on the herbage or grass of a hedge-bank, almost under the hedge, and is then quite conspicuous. I know no moth which more readily catches the eye. When upon an open common or moor it will, however, sit on the heather, and there looks far more like a yellow fallen leaf. Its wings are in no case raised in the manner of many of its allies, at this time, but are quite deflected, the fore wings covering the hind and forming a broad triangle. At night it flies and will come occasionally to light. A rather common species in the Southern, Eastern, and Western Counties of England, and also in the Midlands, and not scarce throughout the remainder of the country to Cumberland and Northumberland. Probably also throughout Wales, since it is recorded from the northern portion, including Anglesey, and I have taken it frequently in Pembrokeshire. In Scotland it seems to be more local yet widely distributed, and recorded from Hawick, Roxburghshire, the Edinburgh district, Wigtown, Renfrew, Lanark, Argyle, Perthshire, Aberdeenshire, and Kincardine-

shire; doubtless in many other localities, since Dr. Buchanan White gives its range as reaching to Sutherlandshire. Widely distributed in Ireland, to Armagh and Londonderry. Abroad it is found throughout Central Europe, the temperate regions of Northern Europe, Northern Italy, Dalmatia, Armenia, Eastern Siberia, and the mountainous regions of Central Asia.

### Genus 22. **HIMERA.**

Antennæ of the male plumose; palpi small; head rough; thorax stout, densely fluffy; abdomen smooth, tapering, but large in the female; fore wings broad, pointed, with long oblique hind margin; hind wings broad and rather squared.

We have only one species.

1. **H. pennaria**, L.—Expanse  $1\frac{3}{4}$  to 2 inches. Antennæ of the male plumose; fore wings red-brown, with two black-brown transverse lines, and before the apex a white dot; hind wings paler brown, dusted with red. Female, antennæ simple; fore wings more narrowed, more of a purple-red colouring, and without the white dot.

Antennæ of the male very densely pectinated with long hair-like teeth which are so slender as to lie loosely and so appear plumose, reddish-brown; palpi small and concealed by long projecting scales; head rough, thickly crowned by a projecting tuft of a bright chestnut colour; thorax extremely fluffy with long loosely spreading hair-scales, orange-red, rather paler behind; abdomen moderately stout, downy, dull yellow; lateral tufts not visible; anal tuft small. Fore wings very broad, pointed; costa faintly arched at the base, then straight to the apex, which is rather acute; hind margin long and oblique, gently curved and very flatly scalloped; dorsal margin rounded, and fully ciliated with long soft scales; colour orange-brown, red-brown, or pale tawny, minutely dusted with leaden-brown; first line rather curved and sinuous; second straighter and more oblique,



slightly waved below the costa; both faint leaden-brown, and the second edged outside with a slightly paler shade of the ground colour; discal spot obscure, leaden-black; a larger cloudy similar ring, enclosing a white spot, lies near the apex of the wing; cilia short, of the ground colour. Female often larger in expanse of wings, which also are a little narrower and more pointed, the fore wings having a projecting tooth or angle in the very oblique hind margin; rather thinly scaled, and of a more purple tinge of red; hind wings whiter; antennæ simple; abdomen very stout but short.

Underside of all the wings of a paler shade of the colour of the upper side; nervures more ochreous; markings faintly reproduced, except that the black-ringed white spot near the apex of the fore wings is quite conspicuous. Body and leg tufts pale chestnut; legs darker.

Considerable diversity exists, in this species, in the positions of the first and second lines of the fore wings; in some specimens these are placed far apart, in others near together; sometimes in the female they almost coalesce; Dr. P. B. Mason has one in which the second actually crosses the discal spot and unites with the first in the middle of the wing; a male in Mr. Sydney Webb's collection has them both broadened into smoky-brown stripes by partial duplication, and has a third stripe composed of smoky-black clouds placed as a sub-terminal line. Variation in size is also considerable—in the collection of Mr. Robt. Adkin is a male over two inches in expanse—a noble-looking creature. Patches of clouding near the transverse lines are not infrequent, in some cases of smoky colour, in others paler, ochreous or even yellow; and in the female the general colour varies from whitish-purple to rich tawny-red. Some of the richer-coloured forms are met with in Ireland. Lieut. Browne reared at Enniskillen in 1894 a male, dark red-brown, with the lines black, and the basal and apical regions clouded with black dusting; and another of a light red, with the transverse lines pale yellow,

and the sub-apical spot entirely black. The females reared with these were pale pinkish-drab.

On the wing in October and November, but occasionally as early as the latter part of September.

LARVA elongated, of even thickness, wrinkled, incisions of segments deeply indicated; on the twelfth segment are two small eminences; head pale brown, the face irrorated with black; body dull purplish slate-colour, or dusted and speckled all over with purplish-grey; having an indistinct, diamonded, ochreous dorsal pattern; subdorsal lines interrupted, pale orange, appearing as spots on each segment; eminences on the twelfth segment tipped with red; spiracles white; undersurface ornamented with a distinct whitish diamond pattern.

But some examples are almost unicolorous slate-grey, with orange sub-dorsal spots. (C. Fenn.)

When young it has an ill-developed pair of prolegs on the ninth segment; the Rev. J. Hellins states that these appear after the second moult, and are again lost at the fourth.

April till June, on oak, birch, blackthorn, poplar, aspen, saw, hornbeam, apple, rose, and privet; feeding principally, though not entirely, at night; remaining on the food-plant by day, and having quite the appearance of a twig.

The egg is laid early in the winter and hatches in the spring.

PUPA rather stout and extremely blunt; reddish-brown, the wing-cases paler. Enclosed in a very large subterranean cocoon of thick silk mingled with grains of sand. Rather long in cocoon before changing to pupa, and liable to be destroyed by any slight disturbance at this stage. (C. Fenn.)

This moth is not very easy to rear in confinement, and the females are extremely apt to become crippled, or dwarfed, or to be imperfectly developed. The males also vary in size,

but when they emerge are generally perfect. Usually, I believe, it remains during the day hidden among thick bushes or the branches of trees, and is rarely found at that time; yet I have seen the male flying in the afternoon, about 4 o'clock, in search of a female, *which it discovered*. At night the male flies vigorously, and is very strongly attracted by light, so as frequently to be seen sitting at that time on a gas-lamp, its wings quite deflected, but its beautiful antennæ conspicuous. The female is extremely sluggish, and I have no record of its being observed in flight. Common in woods and well-wooded districts throughout the South, East, and West of England, and found, less plentifully, in the Midland Counties, and northward to Northumberland and Cumberland; probably also throughout Wales, since it is fairly common in Pembrokeshire. More local in Scotland, but found in the neighbourhood of Edinburgh in Fife, also in Roxburghshire, Wigtown, Lanark, Ayrshire, Argyle, and Perthshire. Dr. Buchanan White gives its range as extending to Moray and West Ross. In Ireland it seems to occur in all wooded districts from Kerry to Derry. Abroad it is widely distributed, through Central Europe, the South of Spain, Northern Italy, Sweden, Livonia, Armenia, Tartary, and Japan—probably also through some portions of Central Asia.

#### Genus 23. **SELENIA.**

Antennæ of the male pectinated; palpi rather prominent; head rough; thorax moderately thick and very fluffy; abdomen rather stout, tapering, smooth; fore wings elongate, retuse, scalloped, and having a strong projecting angle in, or just above, the middle of the hind margin. Hind wings broad, scalloped behind, hollowed toward the anal angle.

LARVÆ twig-like, thick, swollen behind; third pair of legs swollen and raised at the base, and larger than the rest.

PUPÆ rather short and thick, in a silken cocoon.

We have three species, readily discriminated :

- A. A white lunule on fore and hind wings.  
 B. Colour chocolate-red or purple-red, second line undulating. *S. illustraria*.  
 B<sup>2</sup>. Colour reddish-drab, second line erect, straight. *S. lunaria*.  
 A<sup>2</sup>. No white lunules on the upper side of the wing. *S. illunaria*.

1. *S. illustraria*, *Hüb.*; *tetralunaria*, *Staud.* *Cut.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch, but second generation  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings long, pointed, retuse and strongly toothed and scalloped behind; rich chocolate to the second line, thence purplish-white, with the tip deep chocolate; hind wings pale rosy-brown, banded with chocolate; a white lunule on each wing.

Antennæ of the male pectinated with short, solid, curved, ciliated teeth, red-brown; palpi rather short, rich tawny; eyes shining black; head roughly tufted with raised scales, red-brown; thorax stout, thickly covered with long raised fluffy hair-scales, chocolate-red, darkest in front; abdomen not very stout, smooth, purple-brown; lateral and anal tufts small. Fore wings elongated and retuse; costa arched at the base, then straight almost to the apex, which is sharply pointed; hind margin beneath it scalloped and crenulated, almost perpendicular to the middle, where is a strong projecting angle and beneath it a large and very oblique concavity reaching to the anal angle; dorsal margin a little rounded and finely ciliated; colour so far as the second line rich purplish-chocolate, clouded on the costa with rosy-white; first line thick, black-brown, strongly bent or curved outward in the middle; second line erect from the dorsal margin to above the middle, where it curves a little outward and becomes more oblique, but again straightens up as it approaches the costa, black-brown; immediately following it is a broad rosy-white transverse band dusted with purple-

red and shading into a large dull olive-red cloud which occupies the lower hind-marginal space; the upper space to the tip of the wing is filled by a large rich chocolate-red blotch of a somewhat lunate form, very sharply defined and conspicuous; discal spot a semi-transparent white lunule, edged with black; just outside it a slender stripe or central shade of deeper chocolate bends round, and then proceeds obliquely to the dorsal margin; cilia short, dark red-brown, yellowish-brown round the anal angle. Hind wings broad, deeply scalloped and crenulated behind, the two middle points large and projecting; colour very similar to that of the fore wings, rich purple-chocolate to the middle, bounded by a black-brown line continuous with the second line of the fore wings; this is followed by a broad rosy-white band, dusted with dark red and shading off into a large cloud of olive tint toward the hind margin; in the middle of this broad band is a dark chocolate spot; central spot a slender, semi-transparent white lunule or forked streak, edged with black; cilia red-brown, tipped with white. Antennæ of the female simple; fore wings rather narrower and fully as richly coloured; abdomen thick, but pointed.

Markings of the underside a repetition of those of the upper, colours even more vivid and intense, except that along the dorsal margin of the fore wings they are cut off by a broad stripe of the pale ground colour; lunules larger and whiter; on the base of the fore wings and the basal half of the hind, the chocolate colour is very strongly mixed with orange; margins all rather more olive tinted. Body and legs pale rosy-brown, the latter spotted with chocolate.

The second generation, formerly regarded as a distinct species under the name of *delunaria*, is usually smaller, sometimes hardly more than one half the size of the first; its wings less elongated; the colours softer, the chocolate more of purple-red, and the band outside it more rosy. The most remarkable difference is, however, in the form of the second line, which is more undulating and graceful, and



does not rise straight from the dorsal margin, but is there much curved in. On the underside the hind wings are often orange or yellow in the portions usually chocolate coloured, or clouded with olive.

Variable in the tone of colour in both generations: in the earlier, from chocolate or chocolate-red in the darker portions to chocolate-black on one hand, and to many shades of purple-red and rich chestnut, often mixed or clouded with olive-brown, on the other; the paler ground colour takes also various shades, from white to rosy-grey and light rosy-brown. In the second generation the darker portions often lose the chocolate colouring, which is then replaced by purple-red or orange-red or even pale olive-brown with reddish clouding, but the ground colour does not usually become paler in the same degree. The variation in shape of the second line, already remarked upon, is not perfectly reliable, the more curved and undulating form being seen occasionally in the first brood.

The only variety known to me, which is not some modification of the usual form of the species, is one which exists in several large collections; a very fine one from Mr. Bond's cabinet has no trace of the pale band, but the fore wings are chocolate-black from base to hind margin, with the second line only yellow; the hind wings smoky-black, also with a pale-yellow transverse line, but the lunules all normal. This is an extraordinary and very striking aberration.

In all its variations, and both on upper and underside, this is an insect of quite remarkable beauty.

On the wing in April and May, and in a second generation in July and August. In confinement, rare and quite casual examples of a third brood have been reared in October.

LARVA twig-like, rugose, stout; the third pair of prolegs placed upon a fleshy pad; third segment laterally but not conspicuously humped; fifth and sixth each provided with a bifid hump; eighth and ninth much swollen, especially at

the sides, and having small bifid humps; head small and considerably flattened, purple or ferruginous; face shining, paler or whitish; general colour purplish-brown, shaded and marbled with ashy-grey and dark brown; hump on the eighth segment dark brown, edged in front with black, and having an oblique black bar on the sides below it; incisions between the eighth and ninth segments paler, often ochreous; on the middle segments broad, paler, interrupted subdorsal lines are visible; undersurface purplish-grey; space between the prolegs whitish; legs of the same colour or pale ochreous, blacker in front.

June and July, and the second generation in September and October, on birch, willow, oak, ash, beech, alder, willow, aspen, blackthorn and cherry, and will eat, if not provided with these, almost all kinds of deciduous trees and shrubs, raspberry, bramble, honeysuckle and *Cotoneaster*; feeding principally at night, remaining on its food during the day, and looking like a rough thick twig. Very easily reared, particularly if sleeved-out in a secure gauze bag on a tree in a garden. Mr. Merrifield has found it quite advantageous to change the food from time to time, from birch to ash, alder, or cherry.

PUPA short and thick, almost stumpy; the abdominal segments rather drawn in and suddenly tapering; brilliantly glossy; face distinctly knobbed in front; leg-covers closely compacted; antenna-covers thick, prominent and faintly sculptured in cross channels; wing-covers very obscurely sculptured in irregular lines, which do not affect their brilliant gloss; dorsal segments but little pitted, those of the abdomen more so, but with a similar effect, their hinder portions quite smooth; cremaster exceedingly short, thickened and corrugated, tipped with two short slender hooked spines and some minute curled bristles; general colour in front dark purple-brown, dorsal and abdominal regions more deep chestnut; cremaster black-brown. In a very thin but tough

cocoon of shining white silk, which lines a chamber made by drawing together the edges of a leaf, or between two leaves, or among *débris* or moss, on or just under the surface of the ground.

In this state through the winter.

The moth sits during the day on the branches of trees or in bushes, sometimes, indeed, quite conspicuously upon the top of a bush, as though well aware that, from the peculiar rich brown and reddish colouring of its wings, their unusual shape, and its position with wings half raised or more, it presents one of the most interesting instances which we have of deceptive resemblance to a dead and crumpled leaf. At dusk it flies quietly about bushes and sometimes even hedges, and is, in both sexes, in some small degree attracted by light on a dark night. A local species and usually scarce, and perhaps most frequent in extensive woods, yet I have taken it in a garden, and it is not very unfrequent on wooded heaths. It has been taken, more or less uncommonly, and far more often as a larva than in the perfect state, in Kent, Surrey, Sussex, Hants, Dorset, Devon, Somerset, Wilts, Berks, Bucks, Gloucestershire, Herefordshire, Worcestershire, Hunts, Cambs, and Essex; very rarely in Cornwall, and rather so in Norfolk and Suffolk. A single example is recorded each from Derbyshire and Warwickshire, and it has been taken in Salop, Westmoreland, and Cumberland. In Wales it has been found in the south, at Swansea and Pembroke. In Dr. Buchanan White's *List of Scottish Lepidoptera*, it is recorded as occurring at Rannoch, Perthshire, but no particulars are given, and confirmation seems desirable. It does not seem to be found in Ireland. Abroad it has a wide distribution, through Central Europe, Northern Italy, Dalmatia, Livonia, Finland, Southern and Eastern Russia, and Japan—by which may be inferred also some distribution in Central Asia.

This species has been made the subject of certain experiments which are of an interest too great to be here ignored.

In the year 1887, Mr. Francis Galton, in the course of some communications to the Entomological Society of London, made suggestions as to the desirability of so breeding insects as to establish a *pedigree* with definite objects. His wish was to start from the brood of a single pair of moths, and to trace the change of some one characteristic—say of the wing-length—during many successive generations, down three parallel, but well-contrasted, lines of descent; the broods being reared all along out of doors, and under healthy and perfectly identical conditions. One line of descent to be produced by selecting and mating one or more pairs of the largest-winged males and females that are to be found in the brood of the original pair; out of their progeny a similar pair, and thus onward, to obtain the largest producible size. A similar course to be taken with the smallest pair and its smallest progeny; and as a third series, pairs of medium size; and this to be continued for at least six generations. For this purpose it was desirable to find a species easy to rear, naturally somewhat variable in size, and also double-brooded, that the time necessarily occupied might be as short as possible. The present species appearing to be one of the most desirable and suitable in these respects, the task was undertaken by Mr. Frederic Merrifield, of Brighton, with friends; eggs were obtained, the resulting larvæ tended by him with the utmost care and entire success, and the experiment fairly tried during a number of generations. But Nature stepped in with her (unexpected) limitations. By care that interbreeding should not be too close, by repeated change of food-plants, and of other conditions, it was found practicable to continue all the races almost indefinitely; but in the cases of selection of largest and smallest specimens, breeding by selection still larger, and still smaller, it was found that, when the sizes began to go much beyond the range of the species in nature, it was impossible to continue the experiment, the numbers of specimens in a generation becoming so small that there was not scope for the necessary

selection of pairs. But other interesting variations were obtained, races of the species, for instance, of a definitely brighter red, or paler colouring; and by a divergence from the original idea into artificial contrivances for forcing or retarding the development of pupæ, considerable light was thrown upon the causes of difference in colour, and of markings, in the first and second generations. But by no artificial means has it been found possible, as yet, to produce any form so extreme as that which I have described as in the collection of the late Mr. F. Bond, which also was reared by Mr. Merrifield, with several more, many years ago, but under quite ordinary conditions, the only special circumstance being that the eggs from which these unicolorous brown specimens were produced came from that home of dark variations, the South-West Riding of Yorkshire.

2. *S. lunaria*, *Schiff.*—Expanse  $1\frac{1}{2}$  to 2 inches. Fore wings strongly elbowed behind; hind wings deeply scalloped; colour pale reddish-drab or reddish-white, dusted and clouded with red-brown or pale chocolate, especially to the second line, which is erect and straight; apex tipped with chocolate; a black-edged white spot is on the middle of the hind wings.

Antennæ of the male pectinated with solid ciliated teeth, pale tawny; palpi small, fulvous; eyes leaden-black; head rough, dusky-white; thorax not very broad, but fluffy from abundant loose raised fulvous scales; abdomen small and not stout, smooth, pale fulvous; lateral tufts minute; anal tuft small. Fore wings moderately broad, partially truncate; costa faintly arched at the base, thence straight, or even faintly hollowed before the apex, which is sharply angulated; hind margin below it crenulated, perpendicular to below the middle of the wing, where is a strong outward angle and a deep concavity, still crenulated, which reaches the anal angle; dorsal margin a little rounded, ciliated; colour pale reddish-drab, reddish-white, or soft pale fulvous,

with a dusting of redder colour; first line slender, curved, obscurely red-brown or leaden-brown; second line singularly perpendicular and straight, of the same colour, and forming the outer edge of a cloud of rich chocolate-red, which softly shades the greater portion of the area to the base, but is more distinct as a sort of central band, in which a curved oblique central line is faintly visible; the broad area outside the second line is the palest portion of the wing, and becomes still whiter toward the costa; discal spot a small semi-transparent white lunule edged with brown, but often hardly perceptible; the portion of the hind margin next the apex is occupied by a large, lunate, orange-red, or bright fulvous spot; cilia pale fulvous, clouded with brown and tipped with yellowish-white. Hind wings broad, very strongly crenulated behind, two pairs of points being especially produced; between them is a rather deeply hollowed concavity; yellowish-white plentifully dusted with tawny-red; central spot a hyaline lunule edged with leaden-black, and placed in a transverse tawny stripe which is sharply bounded behind by a leaden-black line, and more faintly by similar lines in front; cilia tawny, very short. Antennæ of the female simple and body stout; the wings all paler, often tending toward pale dull reddish-yellow, and the chocolate-red shading paler and fainter; the discal spots are covered with white scales and not diaphanous. In the second brood the male is of a paler, softer colouring, and the lines less distinct; the female yellow-drab, a little dusted with red-brown scales; the transverse lines sharply defined, but the second more waved and curved so as to bend inward a little at the dorsal margin.

On the underside the colour and markings are as upon the upper, except that the portion of the fore wings before the second line and the central transverse band of the hind wings are of a richer and brighter orange-chestnut, and the hinder area of the hind wing is more fully dusted with fulvous. Body and legs fulvous, the tarsi white in front.



There is in this species some tendency to local variation in colour. Those from the Eastern Counties of England are often of a browner tinge of colouring, even brownish-chestnut; those from some parts of Scotland rich purple-red, and very handsome. Some of those reared in confinement, and especially when forced at a high temperature, are devoid of dark dusting, and have the transverse lines very faint, so that their general tint is softened and rather more brownish-buff. In the cabinet of Mr. S. J. Capper is a second-brood specimen in which the second line is obliterated, or rather only represented by an ill-defined shade, while the usual obscure central line has become sharp and distinct. One of the first brood, in that of the Rev. J. Greene, is broadly shaded over all the wings with grey, except a broad whiter costal stripe toward the apex of the fore wings.

On the wing in May and June, sometimes as early as the latter part of April, and in a partial second generation in August and September. The latter, however, is rarely observed out of doors; it seems to be a sort of result of domestication, and this is said even to have extended in one case to a still more partial third appearance in the winter.

LARVA more than usually humped; head rather small, light brown, face yellowish-brown; third segment swollen and provided with two small sub-lateral knobs; fourth excessively thickened beneath, produced into a large projecting pad upon which the third pair of legs is placed; sixth humped on the back and sides, the dorsal swelling surmounted by two darker points; seventh and eighth somewhat swollen, the former at the sides; on the ninth is another large dorsal hump carrying two darker warts; and two raised knobs appear on the twelfth; general colour grey-brown, purple-brown, red-brown, or brownish-green, with faint darker or paler marblings, and usually some suggestion of paler dorsal and sub-dorsal lines; legs coloured in accordance with the body.

End of May, June, July, August, September, October, feeding up quite irregularly in some accordance with its times of appearance in the two generations, in domestication or at liberty. Out of doors it usually feeds from July to September. On oak, birch, ash, elm, blackthorn, and rose; feeding mainly at night, but resting on the twigs, which it so closely resembles, by day.

PUPA very robust; head broad, thick and blunt; antennae-cases thick, raised, with a sharp ridge down the middle and very prominent, showing conspicuously the pectinations; wing-covers embossed all over with thick raised ridges and sinuous channels; abdomen short and thick, its segments, and those of the dorsal region, very thickly sculptured into pits and ridges, except that the hinder band of each is smooth and very dull; cremaster thick and rather conical, armed with a very rough corrugated spike on which are small curled bristles; colour dull pitchy black-brown, cremaster black. In a rather closely fitting silken cocoon between dead leaves drawn together; or in moss on the trunks of trees or walls.

In this condition through the winter.

The moth sits in the daytime with wings more than half erect, the fore wings more so than the hind, on the branches of trees, in bushes or upon them, even quite openly upon hedges or low plants, or on the ground among dead leaves, always protected from any but the most *instructed* eye by its close resemblance to a dried and crumpled leaf. When disturbed it usually falls to the ground, but has been known to fly vigorously to a fresh shelter. Its natural flight is at dusk, and it is strongly attracted by light, sitting at night, with raised wings, conspicuously upon a gas-lamp. I have repeatedly seen it thus in Hither-Green Lane, and close to the gates, on my visits to my kind friend and instructor in Entomology, the late Mr. H. T. Stainton. It still exists, though not commonly, in the outskirts of London, and is

found, though never very plentifully, throughout the South of England; less so in the Eastern and Western Counties; very locally and rarely in the Midlands; and here and there throughout the more northern counties, and through Wales. In Scotland it seems to be not very rare at Hawick, and to be found at Wigtown, in Ayrshire, Argyleshire, Aberdeenshire, Kincardineshire, Inverness-shire, Moray, Ross, and Sutherland, and also in the Orkneys. In Ireland it used not to be very scarce about Powerscourt and elsewhere in the County of Wicklow, and has been found at Sligo and Eumiskillen, and in Westmeath and Tyrone. Abroad it extends through Central Europe, Northern Italy, Sicily, Finland, Livonia, the Balkan States, and Southern Russia.

3. *S. illunaria*, *Hüb.*; *bilunaria*, *Staud. Cat.*—Expanse, first brood,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch; second brood,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings elongated, bluntly elbowed behind; pale dull purplish-drab, shaded and clouded with pale red and purplish-grey; lines red-brown, the central distinct, discal lunule absent or very obscure; a dull red blotch lies at the apex. Hind wings pale purplish-brown.

Antennæ of the male pectinated with short slender incurved teeth of a black-brown colour, shaft light brown; palpi rather projecting, dark tawny; eyes shining black; head rough, hoary-brown; collar red-brown, more hoary in the middle; remainder of the thorax purplish-brown, downy with long raised soft scales, hinder portion paler; abdomen comparatively slender, smooth, purplish-brown; lateral tufts small; anal tuft short and pointed. Fore wings elongated, pointed, rather retuse; costa arched at the base, slightly hollowed before the apex, which is acute; hind margin below it faintly hollowed and minutely crenulated to the middle, there prominently angulated, concave beneath this, but the anal angle prominent; dorsal margin ciliated, nearly straight; colour pale reddish-drab, much dusted with purplish-red or dull red; at the base of the costa is an ovate golden-chestnut

patch ; beyond it the first line is dark purple-brown, gently curved, and bent in toward the dorsal margin ; second line a little sinuous, nearly erect but bent out and then turned and thickened toward the costa ; between these lines, but nearer the latter, is a more oblique and bent cloudy red-brown stripe or shade which crosses the end of the discal cell and touches the very obscure white discal lunule when the latter is visible, which is by no means always the case ; all the lines are emphasised on the costa, and between them that region is somewhat whiter than the general colour, as also is the outer margin of the second line ; hind margin clouded with orange-brown except from the apex to the elbow, which is occupied by a chestnut-red or red-brown lunate blotch edged behind by a whitish line ; cilia yellowish-white dashed with purple-brown. Hind wings broad and moderately long ; pale dull purplish-drab, with two very faint transverse purple-brown lines just before the middle, and a broad ill-defined similar cloud occupying the whole of the hind-marginal space ; cilia yellowish-white spotted with red-brown. Antennæ of the female simple ; body much thicker ; fore wings shorter and more strongly crenulated behind ; the colour usually paler, almost to ashy-brown or purplish-white, but the transverse lines often darker and more suffused.

Underside more handsomely coloured than the upper ; fore wings pale purple-brown dusted with chocolate, the discal spot white, and the three lines blacker ; the apical lunule dark chocolate ; the hind-marginal region behind and below it richly clouded with chocolate, in which is a wavy pale purple shade or sub-terminal line. Hind wings richer purple-brown, the central spot sharply white, placed in a large chocolate cloud ; beyond it the broad hind-marginal stripe is deep velvety chocolate.

The second brood is nearly always smaller, especially so in the male—this species exhibiting the remarkable character that in the first generation the male is much larger, and in the second smaller, than the female—its colouring is of a

softer tone, paler and more tinged with fulvous, the markings more tawny, and those of the underside often tinged with ochreous or orange-yellow; the central stripe is more angulated, and in it the discal lunule is almost always absent.

The principal phases of variation have already been mentioned in reference to the sexes and the two usual generations, but in both there is much irregularity in the distinctness of the transverse lines and in the shades of colouring, some of the earlier specimens being very much more coarsely dusted with dark atoms, and having the central shade dark and spread almost to the first line; while others are quite brightly tinted with chocolate-red, and in the second brood shade to soft pale tones of reddish-white with only the faintest expression of markings. Some of those from the North-East of Scotland are richly shaded with rust-red. In London, Mr. G. B. Routledge found that some pupæ which should have produced specimens of the second generation laid over till February, and did not produce the ordinary spring form, but had the colour of that of the summer, and the first line and central stripe both twisted into segments of circles. In an experiment on retardation by means of ice, Mr. Merrifield obtained moths in which the central stripe or shade of the first brood was visible, and also the more angulated one of the second brood, so that these stripes crossed each other twice in the middle of the wing.

On the wing in April and the beginning of May, and as a second generation in July and August; occasionally in confinement a third generation—resembling the second—is obtained in September or October; and in the course of his experiments Mr. Merrifield, by the free use of warmth indoors, obtained *five* generations in one year, the race then becoming exhausted and dying out.

LARVA twig-like; third and fourth segments enlarged laterally, eighth and ninth swollen, each with two small

dorsal prominences and smaller lateral projections; head small, rounded, brown; face and space between the lobes paler; third pair of legs placed on a fleshy pad; anal extremity furnished with two projecting points; colour variable—ferruginous, purple, reddish-brown, or more usually orange-brown; protuberances darker but edged in front with a paler line; on the sixth segment are two dorsal whitish spots; subdorsal lines paler ochreous or pale grey, interruptedly edged above with black; spiracular stripe bright orange or pale ochreous, conspicuous only on the first four segments; spots and spiracles dull black; undersurface clouded with purple; front surfaces of the legs black. (C. Fenn.) Mr. Buckler figures one larva which has the anterior half of its body orange-brown and the posterior purple-grey, and another of a purple-slate colour with orange bands on the back of the anterior segments; there is also much variation in black or white dorsal markings.

May and June, and the second generation in August and September, on birch, hawthorn, blackthorn, plum, willow, sallow, sweet gale, alder, lime, dogwood, bramble, raspberry, *Cotoneaster*, and honeysuckle. Probably on almost all deciduous trees and shrubs. Feeding principally at night, and remaining upon its food-plant during the day; with the first and second pair of legs folded closely to the body, the third pair is extended almost at right angles to the body, looking like a pair of thorns upon the rough twig which the creature so closely represents.

PUPA short and thick, eye-covers prominent, glossy; limb-covers compact; antenna-covers more prominent, showing, even in the female, broad bars of sculpture, like pectinations; wing-covers short, thickened, glossy, but covered with minute incised lines; all the segments minutely and sparingly pitted, except a narrow band at the hinder edge of each, which is quite smooth; general colour pitchy-brown; the hinder bands of the segments paler brown; cremaster blacker, broad,



blunt, and extremely rugose, armed at the tip with two fine hooked spines and several curled bristles. In a tough semi-transparent silken cocoon between fallen leaves, or in moss ; but often underground, when the cocoon is thickened with earth.

In this condition through the winter.

The moth hides by day in thick hedges and bushes, and if disturbed falls to the ground, so that it is not very frequently observed at that time. At dusk it flies freely along hedges, in lanes, and at the edges of woods, and may be then readily captured, sometimes in plenty. It is somewhat attracted by light, and may often be seen sitting on a gas-lamp. When so sitting, and when in repose in the daytime, the wings are raised quite perpendicularly, and all pressed closely together over the back in the manner of a butterfly, so that the prettily marbled underside becomes the only portion visible. In this it differs greatly from our other species in this group. Found all over England, usually in plenty, but less abundantly in the Midland Counties ; also doubtless in all parts of Wales, since it is common in Pembrokeshire and in the Isle of Anglesey. In Scotland it seems to be more local, and in the West does not seem to extend beyond the Clyde Valley ; but it is found in Perthshire, and in the East to Aberdeenshire and Moray. Widely distributed in Ireland, extending from Cork to Donegal and Derry, and in some districts abundant. Abroad it has a wide range through Central and Northern Europe, Northern Italy, Lapland, Southern and Eastern Russia and Tartary ; also there seems little doubt of its extensive distribution in North America, where the first brood is apparently known as *alciphæaria*, and the second as *kentaria*. It should be observed, however, that in the latter form the central lunules of all the wings seem to be visible, although usually absent in our summer brood.

Genus 24. **PERICALLIA.**

Antennæ pectinated in both sexes ; palpi small ; head rough ; thorax thick, rather downy with short soft raised scales ; abdomen rather short, smooth and tapering ; fore wings pointed at the apex and angulated a little below it ; costa much arched at the base ; hind wings scalloped behind, deeply so just above the middle.

We have but one species.

1. **P. syringaria**, L.—Expanse  $1\frac{1}{4}$  to  $1\frac{5}{8}$  inch, antennæ pectinated in both sexes ; costa of fore wings greatly arched from the base, colour light purple-brown shaded with orange and on the costa with white ; below the apex is a very large orange blotch ; hind wings more uniformly purple-brown. Female paler, tinged with olive.

Antennæ of the male pectinated with short, curved, ciliated teeth, purplish-brown ; palpi small, horizontal, purple-brown ; head grey-brown, rather smooth, a deep transverse furrow lies just beneath the antennæ, thorax not broad, densely covered, as also is the base of the abdomen, with long loose fulvous hair-scales ; abdomen otherwise smooth, purple-brown ; lateral and anal tufts small. Fore wings somewhat rhomboid in shape ; costa very strongly arched from the base to nearly one-half its length, then hollowed almost to the apex, which is sharply pointed ; hind margin immediately below it hollowed into a small concavity, then slightly angulated and projecting, but below smoothly waved and faintly curved ; dorsal margin rounded and ciliated ; colour soft pale purple-brown faintly clouded with orange ; first line represented by a lilac-white shade, broadly triangular on the costa, otherwise slender and curved ; the second line also arises as a lilac-white costal blotch, then is sharply angled, and oblique to the dorsal margin, red-brown ; between these two lines is another, or slender central shade, dark rust-brown, arising close to, and parallel with, the second line,

upon the costa, but angulated sharply back and continued very obliquely to the dorsal end of the first line; a large rich orange-yellow blotch occupies all the middle portion of the hind-marginal area, extending back to and including the middle portion of the second line; above it is a curved lilac-white shade forming the back of an extension of the orange-yellow blotch to the apex; cilia purple-brown dusted with black. Hind wings very broad; hind margin scalloped, one hollow beyond the middle much deeper than the rest; anal angle squared; colour pale purple-brown, near the base is a slender black-brown transverse line in continuation of the central shade of the fore wings, and beyond it a lilac-white continuation of the second, dusted or dotted with black, with which also the dorsal margin is dotted; across the middle of the wing is a faint band of orange clouding, and the hinder area is tinged with the same colour; cilia black-brown. Female rather larger, with antennæ more shortly pectinated; body shorter and thicker; wings all paler and more of a purple-drab tinged with olive, the orange clouding and markings remaining the same, except that the triangular lilac-white or white costal spots are much extended into clouds.

Underside very beautiful; all the wings purple-brown in the male, yellow-brown in the female; with the general surface dusted over with faint streaks of olive-brown, and some yellow shading; the first and second lines pale lilac-pink, and between them a waved parallel black line, shaded with brown; all these lines continuous on all the wings; apical portions shaded with pale lilac, and hind margins with chocolate. Body and legs reddish-brown or yellow-brown.

Remarkably constant, in both sexes, in colour and markings.

On the wing in July; but in confinement occasionally, as a partial second generation, in August and September.

LARVA short, thick, the skin soft, whole surface covered with a minute bristly pubescence; second and third segments tapering in front, the second rounded; on the eighth segment are two long thin fleshy protuberances, curved back and placed side by side like two long hooks; two short, slightly recurved protuberances are on the sixth segment and two of smaller size on the seventh; head rather small, pale brown and having a whitish frontal V-mark; ground colour pale ochreous or orange-brown shaded or tinged with red, yellow, violet or lilac; a broad olive-brown dorsal stripe from the second to the fourth segment occupies the space between the subdorsal lines, which are thence continued in a series of loops, becoming obsolete on the eighth segment; dorsal line darker olive-brown, most conspicuous on the fifth and sixth segments: the back from the eighth to the twelfth segment is occupied by an irregularly diamond-shaped olive-brown patch, edged by a lateral yellow blotch, which is itself divided by an olive stripe; in the centre of the dorsal patch is often a large pink or lilac blotch, dusted with black, and bisected by the dark dorsal line; two minute pale dorsal warts on the seventh and two on the eighth segment surround the larger prominences; anal flap and prolegs edged with white; on each side of the anterior segments is a broad pale yellowish or whitish stripe. (C. Fenn.) Variable in colour—drab, pale brown, rich velvety brown, dark red, and intermediate shades, even occasionally blotched on the sides with green.

August, usually till May or the beginning of June, hibernating when quite small; but in confinement some individuals will feed up very rapidly, producing moths in the autumn, the offspring of which—if any—hibernate at about the same stage as the others. On honeysuckle, privet, and lilac, feeding at night, but remaining during the day, most curiously humped and drawn together, upon the food plant, with all the appearance of a twisted-up dead leaf. It has a very curious habit of rocking itself from side to side when at rest,

especially if annoyed, and this vibratory motion is visible in some degree when it is moving about.

PUPA short and thick, very much thickest in the middle, its back almost hunched; squared in front; abdominal segments rapidly tapering; wing-covers thickened, wrinkled and ribbed, dark red-brown, limb and antenna-covers similar, the latter prominent and showing the pectinations of the antennæ; eyes black and prominent; dorsal and abdominal segments curiously rugose, yellow-brown mottled with whitish-brown, spiracles black in paler rings; cremaster black-brown; short and rugged, furnished with spikes surrounded with curled bristles. Suspended in a silken cocoon of open network attached to a twig of its food plant, the cocoon fitting so closely to it that the larva-skin when cast off is simply pushed between the meshes behind, and remains attached to the bristles of the cremaster, exactly like a long tail.

The moth doubtless sits during the day in thick bushes of honeysuckle, or privet, or in similar shelter, for it is very seldom observed at that time; at dusk it flies gently and softly in lanes, or at the edges of woods, or in their more open portions. Both sexes are attracted by light. Never very plentiful but found throughout the South, East, and West of England not uncommonly, usually in wooded districts; more locally in the Midlands, and becoming scarce in the North, yet recorded in Cumberland, and one specimen each in Northumberland and Durham. There seems to be no recorded instance of its occurrence beyond the border. In Wales it probably occurs in all suitable woods, since I have found it thus in Pembrokeshire, and it is known to occur in North Wales. In Ireland there is a record in the County Waterford, but this seems to require further corroboration. Abroad it is found throughout Central Europe, the temperate portions of Northern Europe, Northern Italy,

Southern and Eastern Russia, Tartary, and the mountainous regions of Central Asia.

### Genus 25. EPIONE.

Antennæ of the male pectinated ; palpi short ; head moderately smooth ; thorax slender, rather fluffy ; abdomen smooth, slender, and rather short ; fore wings short and broad, with expanded hind margin ; hind wings broad, having a point in the hind margin toward the apex and a hollow below it.

LARVÆ twig-like, but without conspicuous protuberances.

PUPÆ lively ; spun up among leaves.

We have three species, readily discriminated :

A. Wings all pale yellow-brown. *E. advenaria.*

A<sup>2</sup>. Wings yellow.

B. A broad complete purple hind-marginal band is broad on the costa. *E. vespertaria.*

B<sup>2</sup>. A broad purple hind-marginal band runs to a point at the apex. *E. apiciaria.*

1. **E. advenaria**, *Hüb.*—Expanse 1 to 1½ inch. Slender, fore wings broad and truncate, whitish-brown clouded and faintly banded with yellow-brown ; hind wings rather similar, with a central black dot.

Antennæ of the male pectinated with short oblique ciliated teeth, light brown ; palpi slender, horizontal, pale drab ; head and narrow thorax rough with raised scales, yellow-brown, the latter paler behind ; abdomen slender, smooth, whitish-brown dusted with darker ; lateral and anal tufts small. Fore wings short and broad, truncate behind ; costa fully arched ; apex squarely angulated ; hind margin perpendicular to below the middle, then curved in and rather hollowed ; dorsal margin ciliated and nearly straight ; colour pale yellowish-brown or whitish-brown, rather silky ; first line much curved, yellow-brown ; second line similar in



colour, rather erect, but forming a small outward angle above the middle, and beneath this slightly concave to the dorsal margin; the space between these lines forms a broad band tinged with deeper yellow-brown; beyond it, half way to the hind margin, is a narrower similar cloudy band indicating at its edge a subterminal line; often one or two similar cloudy patches lie close to the hind margin, which is edged by a brown line; cilia white chequered with smoky-brown. Hind wings rather long, hind margins sinuous, with two rather deeper hollows separated by a projecting point close to the apex; whitish-brown, shaded almost all over with yellow-brown; nervures and a slender angulated middle transverse line more brown; cilia white, clouded with yellow-brown and smoky-brown. Antennæ of the female simple, body very little stouter; extremely similar.

Underside very much like the upper; all the wings pale yellow-brown with white shading, the lines dark brown, enclosing on the fore wings a dark yellow-brown central band. Body and legs of the same colour.

Not variable, except in a very small degree in the depth of colour.

On the wing at the end of May and in June. There is a record, without particulars, of the emergence in confinement of a second generation in August; and I find that such an occurrence has been noticed at large in the woods of Hampshire.

LARVA twig-like, tapering forwards from the sixth segment, and very slightly behind; lateral spots on the sixth to the eleventh segments enlarged, especially so on the sixth; two minute dorsal points are upon the twelfth; head small, rounded, flattened in front, black, dotted with white, and having a white spot on the top of each lobe; body variable in markings, colour, and intensity of colour. Dull purplish-grey or olive-brown; from the fourth to the tenth segments is a series of pale grey dorsal diamonds in which the ordinary

raised dots appear black and distinct; on the sixth segment are two pale yellow oblique dashes forming a dorsal **V**, the apex in front; spiracular stripe much waved or vandyked, broad, conspicuously whitish or yellowish, emitting a whitish dash, upwards and backwards, on each segment from the fifth to the ninth; spiracles black; undersurface of a redder brown than the ground colour, with a series of dark brown **V**-shaped markings, the apex behind; or with a row of brown diamonds, outlined with darker brown. The small dorsal protuberances on the twelfth segment tipped with ochreous or yellow; on the second to the fourth segment are thread-like whitish subdorsal lines; the spiracular stripe, often much interrupted, forms a series of lateral **V**'s filled up with dark olive, the apex of the **V** in front.

Or, olive-brown shading into dark brown in front, and to chocolate behind; on the sixth segment are yellow oblique spots; the pale dorsal diamonds are very large, each with a pair of black spots; dorsal line darker brown, indistinct and interrupted; subdorsal spots distinct, white; spiracular stripe and dashes as in the other variety, but edged with a deep olive-brown shade; the yellow dorsal spots on the twelfth segment are placed in a blackish blotch; otherwise as in the other form.

July and August, sometimes September or even October, on whortleberry, rose, sallow, dogwood and bramble. Hofmann says also on *Melampyrum* and *Fragaria* in shady woods. Feeding at night; remaining on its food-plant in the day; if disturbed dropping to hang on a thread of silk, so coiled up as to resemble a morsel of dirt.

PUPA very stout, much the thickest in the middle; the wing covers tumid, much wrinkled, and sculptured in fine irregular lines; eye and head covers prominent; antenna covers raised into conspicuous ridges, and squarely sculptured throughout into bars and pits; limb covers closely appressed; all these portions olive-green, not very glossy;

dorsal and abdominal segments light brown, abundantly covered with minute pitting, which rather dulls the gloss, except at the hinder margin of each segment, where is a smooth, shining, darker brown band; cremaster short, thick, rounded, tipped with a bunch of fine hooked bristles. In a soft, slight, silken network cocoon, in a crevice in moss or under a decayed leaf.

In this condition through the winter.

In sunny weather the moth flits gently about in the daytime among its food-plants—in my own experience principally among whortleberry—in open woods, settling upon the tops of the plants, with its wings three-fourths erect and ready at the smallest disturbance to flit in the same lively manner away, but if the sun becomes obscured, will creep under a leaf for shelter. So far as I know there is no reason to suppose that it flies at all at night. Its habits vary, since in one place it will frequent, and settle upon, whortleberry only, in another, on rose, or dogwood, or bramble, its larvæ appearing to be similarly fastidious. Very local and apparently confined to woods, but usually common where it occurs—in Kent, Sussex, Surrey, Hants, Berks and Essex—very rare in Wilts, extremely local in Devon, Somerset, Gloucestershire, Herefordshire, Worcestershire, Salop, confined to one locality in Derbyshire, and extremely local in South Yorkshire. In Wales it is only recorded from Sketty Park, near Swansea; and I find no records for Scotland or Ireland. Abroad it has an extensive range—Central Europe, Northern Italy, Livonia, Finland, Armenia, Tartary, the Corea, the mountainous regions of Central Asia, China, and Japan—where it is quite typical and very abundant!

2. **E. apiciaria**, *Schiff.*—Expanse 1 to  $1\frac{1}{4}$  inch. Fore wings acuminate, hind wings with a hollow in the hind margin; colour orange-yellow, all the wings bordered with a broad pale purple band which runs to a point at the apex of the fore wings.

Antennæ of the male pectinated with long slender ciliated teeth, yellowish-white ; palpi small, tawny ; eyes dark purple ; head orange-fulvous, having a transverse furrow beneath the antennæ ; across the base of the collar is a dark purple band ; remainder of the thorax rather loosely scaled, orange-yellow, slender ; abdomen also slender, smooth, pale yellow ; lateral tufts minute ; anal tuft pointed. Fore wings short, broad and retuse ; costa strongly arched ; apex curved to a point ; hind margin below it concave, then filled out conspicuously in the middle, and curved off below, but the anal angle well defined, dorsal margin rather rounded, finely ciliated ; colour orange-yellow ; the nervures all orange-red, and the surface dusted with the same ; first line slender, purple-black, forming a strong elbow or angle outward ; second line rather waved, abnormally placed, arising from the middle of the dorsal margin and running very obliquely to the tip of the wing, black ; outwardly it edges a purple band, which, shading off paler, fills the hind-marginal area, running necessarily to a point at the apex ; discal spot a small black dot ; cilia dark purple, paler at the tips. Hind wings rather rounded, the hind margin having a faint concavity close to the apex and a deeper one below it ; colour orange-yellow ; nervures orange-red ; central spot a small black dot ; in the middle is a transverse purple-black line, beyond which the hinder portion of the wing is purple, clouded toward the margin with orange ; cilia dark purple tipped with paler. Female very similar, with simple antennæ and rather stouter body ; but often the purple marginal band of the fore wings is deeper in colour.

Underside a repetition of the upper, but the yellow is paler, and more dusted with purple, and the inner edge of each purple hind band is clouded with black. Body and legs dull purple tinged with yellow.

Rather variable in the depth of orange-yellow of the ground colour, and very so in the tone of purple in the marginal bands ; this is sometimes as deep in the male as in

the female, but often it is shaded paler or clouded with orange, and not unfrequently has merely a faint clouding of purple, this colour being replaced by orange; also there is every possible intermediate shade. Mr. Sydney Webb possesses a specimen in which this band on all the wings is of as bright an orange-yellow as the rest of the surface; and another in which it is, on the contrary, of a dull *lead*en purple. Mr. S. J. Capper has one in which the band is purple-black. There is variation also in the breadth of the marginal bands irrespective of colour; and I possess a male specimen in which they are of double the normal breadth, the second line being, in it, removed from its usual position to the middle of the wing and very near the first line, while it reaches the costa at a considerable distance from the apex. In all fluctuations of this nature the hind wings agree.

On the wing in July and August; and occasionally in a very partial and uncommon second generation in September or October.

LARVA twig-like, smooth; seventh segment considerably swollen laterally, and with two small dorsal eminences; sides puckered; there is a small projection on each side of the mouth; head small, flattened, dull purple, with a white or yellowish transverse bar above the mouth; colour variable, greenish-brown or yellowish-brown with numerous dark grey longitudinal wavy markings; an ochreous or pale yellow dorsal patch, enclosing a Y-shaped black mark, extends from the fourth to the apex of the seventh segment, and is sometimes continued on the succeeding segments in the form of dorsal diamonds; dorsal dots white or pale straw colour, surrounded with black; spiracular line waved, pale ochreous, edged above with hazle-brown, darkest on the seventh segment, and uniting with a broad whitish, or pale ochreous, band on the first pair of prolegs; on the undersurface are two interrupted dark grey bands, or a row of black spots having white centres. (C. Fenn.)

April till the beginning of July, on willow, alder, and occasionally hazle; feeding at night; remaining during the day upon its food underneath a leaf, but easily disturbed, when it hangs by a silken thread.

PUPA elongate, shining, dark red-brown. Enclosed in a very loose silken cocoon among moss, or under the fallen leaves of its food plant. (C. Fenn.)

The winter is passed in the egg-state.

The moth sits during the day, with deflected wings, among its food-plant, preferring the thickest portions, or even dense herbage underneath, but may be beaten out and induced to fly; its natural flight is at dusk and again in the night, and it will come readily to light. Especially attached to moist places, bushy marshes, and fens, and in the latter may be seen by the aid of a lantern, after its evening flight, sitting upon the leaves of the tall reeds, or on the willow bushes, its wings then raised erect. It may also be found in damp lanes where willow is plentiful in the hedges, at the sides of meadows, and about damp woods. Common in suitable places throughout the South of England, including the Western and especially the Eastern Counties, where it abounds in the fens; less frequent in the Midlands, and rather scarce in the Northern Counties. Probably to be found throughout Wales, since I found it commonly in the lanes in Pembrokeshire. In Scotland local and not very common, but extending to Argyle in the West and northward even to Sutherlandshire. In Ireland it is recorded from near Dublin, Wicklow, Cork, Galway, Sligo, Westmeath, Cavan, Fermanagh, Antrim, Tyrone, Donegal, and Derry. Abroad its range extends through Central Europe, the temperate portions of Northern Europe, Northern Italy, Dalmatia, Southern Russia, Tartary, and the mountainous regions of Central Asia.

3. *E. vespertaria*, *L. parallelaria*, *Staud. Cat.*—  
Expanse 1 to  $1\frac{1}{2}$  inch. Fore wings short and truncate, hind



margin scalloped; colour orange-yellow with the nervures purple; a broad deep purple marginal band on all the wings, arises on the fore wing from the costa before the apex. Female pale yellow with a slightly different marginal band.

Antennæ of the male pectinated with oblique, rather slender, ciliated teeth, blackish-brown, the shaft yellow-white; palpi small, reddish-ochreous; face similar, smooth, separated from the upper portion of the head, which is golden-yellow, by a transverse furrow; collar dull purple; remainder of thorax rather smooth, yellow, dusted with purple; abdomen slender, smooth, dull pale yellow; lateral tufts minute; anal tuft pointed. Fore wings short, broad, and truncate; costa arched throughout; apex bluntly angulated; hind margin perpendicular to the middle, thence a little rounded off; dorsal margin ciliated, nearly straight; colour orange-yellow dusted with purple; nervures all purple; first line slender, much curved, purple, with a superficial leaden hue, which also is continued along the costa back to the base; second line leaden-black, very sinuous, and throwing out a blunt angle in the middle; the whole hind-marginal area beyond it dark purple, faintly clouded in the middle with golden-yellow, and forming a very handsome broad marginal band; discal spot obscure, red-black; cilia dark purple. Hind wings broad, rounded behind, but with a hollow in the margin below the apex; orange-yellow, dusted to beyond the middle with short purple streaks; nervures purple; continuously with the second line of the fore wings is a slender, sinuous, black transverse line, which forms the inner edge of a broad dark purple marginal band, as in the fore wings; cilia purple, tipped with white. Female very different; antennæ simple; body stouter and a little shorter; ground colour of all the wings pale yellow, without any dusting or stippling of purple between the first and second lines, or in this space any similar colouring of the nervures; but in the small space before the first line of the fore wings it is as in the male; the second line is usually more elbowed outwards

in the middle, and runs almost into the apex of the wing, so that the purple marginal stripe is here differently shaped; in the hind wings the margin of the purple band is also excavated by a similar outward bend of the transverse line; sometimes a minute central dot is visible on all the wings.

Underside in both sexes, so far as the colours and the form of the purple marginal band are concerned, as on the upper; in the male the orange-yellow surface is dusted, but not veined, with purple. Body and legs purple; tarsi yellow.

There is some little variation in the male in the depth of the orange-yellow ground colour, and in the degree of purple dusting, also in the intensity of the purple of the marginal band; in rare instances the ground colour is pale yellow with the usual dusting; in others it is of the usual tint but without the dusting; and again, in others, deep dark chestnut-red. One such as this last is in the cabinet of Mr. Sydney Webb, and also a most curious gynandrous example: its antennæ are male, but the pectinations on the right antenna are scarcely so long as on the other; the body is male, the right fore wing female, the left partially so, but the band is more as in the male, and the hind wings are male. In my own collection is a beautiful female having the marginal band of all the wings shaped as in the male; its first line instead of being curved is sharply angulated; and another female is on record which has the complete markings of the male.

On the wing in July and August, sometimes even September.

LARVA rather stout, wrinkled, much attenuated in front, sides puckered; a small lateral projection on the sixth segment; head rounded, not shining, smoky-brown; dorsal region dull smoky-brown; dark greyish-brown from the second to the fifth segment; sides rather darker; a pale ochreous or brownish patch upon the sixth segment precedes two oblique black dashes which meet in the middle of the

back; before the pale patch is a black dorsal spot; subdorsal lines white or yellow, exceedingly fine, most distinct on the fifth and sixth segments; subdorsal spots small, conspicuously white, edged with velvety-black; usual raised dots black; undersurface bluish-white faintly tinged with lilac, and with two obliquely placed black blotches on each segment; or with a broad blackish central stripe, containing two pale threads. (C. Fenn.)

May till the beginning of July, on *Salix phylicifolia*—one of the dwarf willows—also upon dwarf sallow, birch, and aspen, and in confinement on weeping willow.

PUPA very lively; spun up among the leaves of its food-plant; apparently undescribed.

The winter is passed in the egg-state.

The male moth flies in the early morning sunshine, and again at evening dusk, and late at night; the female is much more sluggish, hardly ever seen on the wing and only occasionally captured sitting upon the leaves of its food-plant; but having no personal experience I am inclined to quote the remarks of one of my earliest friends and co-workers, the late Mr. Edwin Birchall. "I had the pleasure lately, of visiting, near York, the only English station of *Epione respertaria*. A flat boggy moor, covered with dwarf sallow bushes and ling, and scattered Norway pines, looks and feels a dreary place soon after sunrise; the aspect of nature varies with our own changing moods, and even fine scenery has no charm for a sleepy man. But it is *respertaria's* chosen place and hour; about 7 A.M. the first specimen is seen on the wing, another and another rises, and presently the whole beath is alive with the brilliant little orange moths. By 9 A.M. the numbers are sensibly fewer, and soon not one is to be seen, the flight is over for the day. All the insects on the wing were males; the female may be occasionally found ghangin to a twig of sallow, but seems never, or rarely, to take flight. No disproportion of the sexes, however, exists;

when reared from the larvæ the numbers are equal." It is reasonable to conclude that the female is more active at the night flight. The locality to which the above notice refers—Sandburn Moss and Strensall Common, near York—is the principal home of this pretty species in these Islands; but there are two or three records of its casual occurrence further south. A single specimen, which I have seen, was taken by Miss M. Kimber in a lane near Cope Hall, Newbury, Berks; one was taken near Arundel, Sussex, in August, 1879; one is recorded from St. Ives, Hunts; and two from Norfolk. Further north Mr. G. Bolam has met with it occasionally—as a smaller race—in Northumberland, in bogs toward the northern border of the county. In Scotland it has been taken near Hawick, and in 1897 was found by Mr. W. Salvage well distributed in Sutherlandshire, from the sea level, to about a thousand feet above, on the mountains. So far as I know it has not been met with elsewhere in these Islands. Abroad it has a wide distribution through Central Europe, the temperate portions of Northern Europe, Northern Italy, Southern and Eastern Russia, Tartary, and the mountainous regions of Central Asia.

#### Genus 26. **METROCAMPA.**

Antennæ of the male pectinated; palpi minute; head rough, but with a transverse division; thorax broad, moderately fluffy; abdomen more slender, smooth; fore wings very broad, pointed; angulated in the middle of the hind margin, margin not hollowed beneath it; hind wings broad, crenulated, and with a projecting angle in the hind margin.

We have only one species.

1. **M. margaritata**, *L.*—Expanse  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches. Wings all ample, angulated behind, whitish-green; fore wings having two whitish transverse stripes and a brown apical dot; hind wings faintly tailed and having one central white transverse stripe.

Antennæ of the male pectinated with slender, oblique, solid, ciliated teeth, pale brown, shaft white; palpi small and slender, pale brown; face smooth, white below, shading above to red; beneath the antennæ is a deep transverse channel, above which the head is rough and white; thorax moderately stout, greenish-white, roughly and loosely covered with long scales; abdomen rather slender, tapering, silky-white; lateral and anal tufts spreading. Fore wings broad and ample; costa arched throughout; apex angulated; hind margin rather straight to the middle, there elbowed and again almost straight to the anal angle, which is well formed; dorsal margin gently rounded, ciliated; colour pale bluish-green; costa white; first line straight, oblique, white, faintly edged outside with yellower green; second line more oblique, nearly straight, but curved up toward the costa, white, edged more broadly inside with fuller green; in the cilia at the apex is a chestnut spot; the remainder of the cilia silky-white, waved and so depressed as to give the impression of being shot with darker. Hind wings large and broad, pale bluish-green; in the middle is a straight transverse white stripe, continued from the second line of the fore wings, and similarly edged inside with yellow-green; hind margin crenulated and in the middle having an angle almost suggesting a short tail; cilia silky-white. Female usually much larger, with simple antennæ, broad thorax, and much stouter abdomen; wings very ample, and the central stripe of the hind wings rather curved.

Underside white with a very slight green tinge, rather more noticeable in the fore wings, but the costa of the latter tinged with pale fulvous; the transverse lines of the upper side faintly visible. Body white; legs very pale brown.

The delicate green colour in this species fades gradually so that there is change of colour according to the antiquity of the specimen, sometimes to white-green, sometimes to a dull tinge of yellow or pale buff. When fine there is little variation but sometimes the apical chestnut spot is obliterated,

and the first and second lines of the fore wings are not quite constant in their positions. A specimen in the collection of the late Mr. H. Doubleday, in the Bethnal Green Museum, has them so near together that a narrow central band is formed by them, running to a point in the dorsal margin, where they actually meet.

On the wing in June and July.

LARVA not cylindrical, the undersurface being flat; provided with an extra pair of effective prolegs—that is, two pairs of ventral, and one of anal prolegs—but no trace of any ineffective legs; third and fourth segments much thickened; then there is a regular increase in size from the fifth to the eleventh, the divisions between all being well marked; on the twelfth is a small double eminence; the raised dots are black, tipped with white, those on the hinder segments being conspicuous; face flattened, grey; head darker grey, dotted with brown, and having a curved black streak on each lobe; general colour brownish-green, drab, purple-brown, or purple-grey, often dusted with darker; legs of the same colour; sometimes the seventh and eighth segments are slightly banded with a darker shade; along the spiracular region is a curious series of fleshy bristly filaments, of the colour of the body.

September till May, on oak, birch, willow, hawthorn, blackthorn, hornbeam, ash, beech, elm, and other deciduous trees, also on broom; hibernating on the food while quite young, but feeding, in mild weather, throughout the winter, on the buds and bark of the young shoots.

PUPA not very stout, the body portion approaching to cylindrical but a little thicker in the middle; wing-covers dull from very abundant minute lines of irregular sculpture; antenna-covers strongly cross-ribbed in the form of the joints and pectinations; limb-covers closely compressed; segments glossy, the middle portions furnished with scattered punctures which are not very abundant; abdominal segments regularly



tapering except that the last is thickened; cremaster large and prominent, rugose and flattened beneath, armed with two long parallel spikes. General colour deep chestnut, divisions of segments paler; cremaster black. In a cocoon of white silk among rubbish or dead leaves on the ground.

The moth hides during the day in trees and bushes, and may readily be beaten out, when it flies wildly and swiftly to a similar shelter. Its natural flight is at evening and morning twilight, and it is then very active and vigorous, flying high around trees; at night it is strongly attracted by light. A plentiful species at the edges of large woods, and occurring in more moderate numbers among trees and even along hedges, in wooded districts, all over the southern half of England, and more locally throughout the remainder, and Wales; also throughout Scotland to Moray and West Ross, at least, and in the Isle of Skye. It is also found in Ireland wherever woods exist, and often commonly. Abroad it is distributed throughout Central Europe, Sweden, Central and Northern Italy and Northern and Eastern Turkey; also through much of North America, to California and Vancouver.

#### Genus 27. **ELLOPIA.**

Antennæ of the male pectinated; palpi slender; head smooth; thorax narrow, downy; abdomen slender, smooth, much stouter in the female; wings thinly scaled, broad, and having all the margins smooth and even.

We have but one species.

1. **E. fasciaria**, *L. prosapiaria*, *Staud. Cat.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Entirely purplish-red; fore wings with a deeper red central band; hind wings with a similar line.

Antennæ of the male pectinated with oblique, curved, ciliated teeth, very pale brown, shaft white; tongue long, yellowish-white; palpi extremely small, light brown; face smooth, bright red or terra-cotta colour, divided from the

upper part of the head, which is pale reddish-drab, by a transverse channel; thorax narrow, pale red; abdomen smooth and slender, pale buff; the lateral and anal tufts and the edges of the segments shining whitish-buff. Fore wings somewhat ovate, costa flatly arched; apex bluntly angulated; hind margin rather oblique and smoothly, very gently, rounded; dorsal margin rounded and fully ciliated; colour red-buff, abundantly dusted with bright red or purple-red; first line a whitish slender stripe edged outwardly with bright red, oblique and much curved back to the costa; second line also oblique and curved back to the costa, but rather leaning toward the first line below the middle, slender, whitish, edged with red on its *inner* side; the remaining space between the two lines more strongly dusted with red than the other portions of the wing, and forming a central band; cilia silky, undulating, reddish-buff, paler at the tips. Hind wings broad and regularly rounded, whitish-buff abundantly dusted with bright red atoms, and having a similar central transverse stripe or line in continuation of the second line of the fore wings; cilia reddish-buff with paler tips. Female larger, the thorax broader and the abdomen even more robust; antennæ simple; colour and markings similar, or more dull red, or brownish-red.

Underside of all the wings whitish-buff, the costal half of the fore wings tinged with red, deeply so toward the base; devoid of markings, except a faint suggestion of the second line of the fore wings, and a more distinct one of the line upon the hind wings. Body and legs pale red.

Usually tolerably constant in colour and markings, but occasionally the two lines of the fore wings are drawn nearer together in the middle, the second being the less stable of the two. Specimens of a deeper, darker red colour are now and then to be met with, and become more frequent in the Midlands and in Northern districts. In Salop a form is found of a grey-red colour, and even dark greenish-grey. This serves as a passage to the variety known as *prasiniaria*, in which all

the red colour is exchanged for green, except that the transverse lines become reddish-white and the cilia continue red-buff. Of this form a very beautiful specimen was exhibited at one of the pleasant little gatherings at Mr. Stainton's house, nearly forty years ago, by Mr. A. H. Jones; it had been captured at Eltham, by his brother, in June 1861, and is still in his collection. Another is in the collection of the late Mr. F. Bond. A third, reared in 1882 from a larva beaten out of pine, with many more, at Brandon, Suffolk, by the Rev. G. H. Raynor, is of a soft olive-green with pink lines; and one taken at Aldeburgh, Suffolk, in July 1892, by the Rev. C. T. Cruttwell, is of a soft, delicate pea-green with similar lines. In all these the cilia remain red. This form in various shades of green is not scarce in Switzerland and some parts of Germany. In the collection of Mr. J. E. Robson is a Scotch specimen, dull purple-grey; and other specimens from that country are purple-buff and of intermediate shades.

On the wing in June and July, and casual specimens of an extremely partial second generation have been taken in September. Commonly double-brooded on the Continent.

LARVA smooth, skin shining; of even thickness; on the ninth segment is a pair of rudimentary prolegs useless for walking; two minute dorsal points, on each segment from the fifth, gradually increase in size to the twelfth; sides puckered; undersurface rather flattened; head rounded, orange-brown marbled with red; general colour orange-brown—the colour of the sheaths of the young pine leaves—with a series of deep dull red dorsal triangles, the apex of each behind, and bisected by an inconspicuous reddish dorsal line; subdorsal lines whitish, distinct, most so at the sides of the dorsal triangles; usual spots minute, tubercular, white, emitting very short blackish bristles; sides broadly shaded with red; undersurface very conspicuously pale greenish-white, dusted in the middle; legs orange-brown.

When younger pale yellowish-brown, clouded with red or orange-brown in the vicinity of the larger tubercles; dorsal line slightly darker brown, edged at each incision by a short black dash, which is continued obliquely forwards to the tubercle on the preceding segment; the included space or triangle thus formed being dark purplish-brown; the whitish raised dots are surrounded with grey or reddish-brown; head pale brown, faintly marbled with reddish-brown, and having a paler dot on each lobe; undersurface and legs pale ochreous tinged with green. (C. Fenn.)

When very young this larva is bright red, almost crimson.

August till May. hibernating while very small; on *Pinus sylvestris*, and sometimes on other species of fir.

PUPA short and rather thick, abdomen tapering rapidly off; eye-covers glossy; tongue and limb-covers barred with faint channelled sculpture; antenna-covers very prettily barred. showing the shaft and every tooth of the pectinations; wing-covers abundantly covered with, and rendered dull by, multitudes of cross and lengthwise minute channels of sculpture; segments plentifully pitted, except the smooth hinder bands, which are narrow; cremaster a strong thickened triangular projection armed with two parallel spikes and a few twisted bristles; colour red-brown, cremaster hardly darker. In the ground, in a cocoon of silk and earth.

The moth usually rests in the day time in the lower branches of the pine trees, and may often be dislodged and induced to flutter down to the ground, by a heavy blow upon the trunk of the tree. Sometimes, when just emerged, or when shaken down by a violent wind, it may be found upon brambles, fern, or other herbage under the trees, sitting always with deflected wings, and looking sufficiently like a flake of red fir-bark. It may occasionally be captured at a strong light. Found only about fir woods, but in them often common, throughout England, and in Scotland so far as

Argyleshire, Perthshire, Inverness-shire and Moray, even to a height, where the fir woods extend up the hills, of 500 feet above sea level. Probably very local in Wales, since it seems only to be recorded in Glamorganshire. In Ireland it seems probable that its complete extinction and re-introduction may have taken place within a comparatively recent period. Mr. Kane points out that the indigenous pine became extinct about the time of Queen Elizabeth, and that, according to the *Cybele Hibernica*, "there is no satisfactory proof of the survival of native Irish *Pinus sylvestris*." "The forests of Wicklow, from which some nine hundred years ago the King of Leinster cut a tribute of fir masts for Brian Boru, survives only in oak and other trees which spring again from stools; and in the free-seeding birch." He thinks that it must have been introduced during the last few hundred years, when settlers began to import and plant conifers. If this is so, the insect has again become well distributed, since it has been obtained in Dublin County, Wicklow, Waterford, Cork, Kerry, Galway, Sligo, Westmeath, King's County, Louth, Fermanagh, Tyrone, Armagh, Down, Antrim, Donegal, and Derry. Abroad it has an extensive range through Central Europe; all but the coldest portions of Northern Europe, including part of Lapland; Northern Italy, the Ural Mountain district, Siberia, and the mountainous regions of Central Asia.

#### Genus 28. **BISTON.**

Antennæ strongly pectinated; palpi shaggy; head rough; thorax very robust, shaggy with long thick raised scales; abdomen very stout, roughened with long scales and fine hairs; fore wings elongated, thickly ribbed, hind margin very oblique; hind wings not large, sinuous behind.

LARVÆ large and long, rather thickened at the extremities; head somewhat divided.

PUPÆ in the earth.

We have three species ; easily recognised :

- A. Fore wings thinly scaled, yellowish-grey, striped with black. *B. hirtarius*
- A<sup>2</sup>. Fore wings white with black speckling and two pale chocolate bands. *B. prodromarius.*
- A<sup>3</sup>. All the wings white, dusted with black, or else wholly smoky-black. *B. betularius.*

1. **B. hirtarius**, L.—Expanse  $1\frac{3}{4}$  to 2 inches. Antennæ strongly pectinated ; head and thorax hairy, the latter very stout and fluffy ; fore wings thickly ribbed, thinly scaled, yellowish-grey, dusted with black, and having black transverse narrow stripes ; hind wings thinly scaled, pale grey.

Antennæ of the male broadly pectinated with long, slender ciliated teeth which cease before the apex, leaving it merely notched, black-brown ; palpi hidden by masses of hairy scales ; head rough from similar erect scales, dull brown ; thorax broad and very thick, covered by a great mass of upstanding scales, yellow-brown, transversely barred with black on the collar, the middle, and the hinder portion, where the long scales form two small crest-like knobs ; abdomen short, moderately stout, but tapering, reddish-brown, rough with long scales which form one or two prostrate dorsal tufts, blacker than the rest ; anal tuft thin and rather ragged. Fore wings elongated, costa very faintly hollowed to beyond the middle, thence slightly rounded ; apex squarely angulated ; hind margin beneath it rather full, but sweeping off obliquely in a long curve ; dorsal margin nearly straight ; colour yellowish-grey finely dusted with black ; first line curved, black, spread upon the nervures ; second line deep black, gracefully curved outward and back to the costa ; between these two, but nearer the latter, is an irregular black central stripe, and outside the second line, in contact with it, a more or less distinct grey-black band, blackened on all the nervures, and followed by a narrow pale stripe of greyish-yellow ; outside this the hind-marginal region is a little clouded with



darker grey ; cilia yellow-grey dotted with black. Hind wings not broad, the costal margin remarkably straight and the apex angulated ; hind margin rather sinuous or curved, most prominent in the middle ; semitransparent, pale grey, faintly dusted with pale yellow ; before the middle is a slender smoky-black stripe, followed by another more curved and sinuous, and by a third, more diffused, along the hind margin ; cilia yellow-grey, spotted with black. Antennæ of the female simple ; body much thicker ; fore wings rather longer and more ovate, semitransparent between the nervures, which are thickened and more extensively blackened ; the general colour grey, often with very little yellow dusting ; hind wings also larger, greyer, and much more thinly clothed with scales.

Underside of all the wings smoky brownish-grey, minutely dusted with yellow and with black ; the transverse lines obscurely indicated ; cilia more distinctly spotted with black. Body reddish-brown ; legs excessively tufted with similarly coloured long hair-scales ; tarsi barred with black.

Usually a sufficiently constant species in both colour and markings, yet specimens showing slight variations in the ground colour toward grey-brown, or to an excess of black dusting, or toward yellowish-white in the paler stripes, and also in the depth and distinctness of the black transverse stripes, may be secured without very much difficulty ; and there is, I think, in London a tendency towards yellow dusting in the male, and to blacker general colour in the female. In the collection of the late Mr. H. Doubleday at Bethnal Green Museum is a specimen wholly black ; on the other hand, Mr. S. J. Capper has examples of the same sex from the New Forest of a pale reddish-grey with the transverse lines light brown ; and in the late Mr. F. Bond's cabinet are males from Scotland of a very curious pale grey. In his collection, now in Mr. Webb's possession, is also a most singular gynandrous specimen ; its body and wings being female, but its antennæ partly male. This was taken in the Regent's Park, London.

In the same collection is a black example, and one of a very pale brown, almost transparent. Scottish specimens, which are rare, are not all uniformly pale grey; a male from Perthshire in Mr. Percy Bright's collection, although of this ground colour, has the black lines and band so much suffused and intensified as to form a very handsome variety. A strong tendency toward grey colouring without the yellow dusting seems to exist in the Eastern Counties; while in Oxfordshire there is sometimes increased *size*, a specimen taken by Mrs. Bazett in the beech woods near Reading being a quarter of an inch larger in expanse of wing than usual. Finally, the Rev. Joseph Greene possesses a beautiful male in which there is considerable increase in the yellowish-white area, which extends into the middle of the wings and upon the costal margin; and another having six deep black transverse stripes.

On the wing in March and April.

LARVA stout, cylindrical, smooth; sides slightly puckered; head rather bifid, flattened in front, smaller than the second segment, greyish-purple, dusted with black; mouth dark brown, edged with yellow; twelfth segment with two slight dorsal eminences; greyish-purple, clouded and mottled with darker, the whole surface covered with fine threadlike longitudinal black lines; front edge of second segment conspicuously yellow; two yellow spots on the back and one immediately following the spiracle, on the sixth, seventh, eighth, and ninth segments; dorsal eminences on the twelfth tipped with dark grey; thirteenth dusted with black and having two small projections behind; legs pale pink tipped with brown; the undersurface between these light yellow; space between the prolegs pale brownish-ochreous. When very young it is almost black, distinctly banded with yellow at the incisions. (C. Fenn.) Sometimes the greyish-purple ground colour is exchanged for pale yellowish-grey, or for green-grey or red-brown.

May to July, on lime, elm, poplar, willow, sallow, birch,

ash, blackthorn, apple, lilac, and apricot, feeding at night, resting by day on the twigs or branches of trees, or, when well grown, very often upon the trunks, stretched stiffly out, but holding on with legs as well as prolegs. and then bearing the most remarkable resemblance to a short bit of very dirty string nailed to the tree.

PUPA stont, anal extremity tapering and spiked, surface rather rough; dull purplish-brown. Subterranean, enclosed in an extremely brittle earthen cocoon. (C. Fenn.)

The eggs are deposited in large batches or cakes in the crevices of bark; and, unless some substitute be provided into which the female can thrust deeply her ovipositor, she cannot be induced to deposit them in confinement. It is, however, sufficient to satisfy her, that she be confined in a pill box *which is not quite closed*; she will then pass them through the chink, and *lay them upon the outside*. They are usually bright green, but Mr. Robert Adkin observed that in the case of two females in his possession, which were induced to deposit, those first laid were dark green, those three or four days later orange-yellow, and those still later very pale yellow. None changed colour—except to leaden before hatching—*all hatched*, but in each case the third batch *before* the second, or orange batch.

The habits of this moth are somewhat peculiar; its especially favoured haunt in this country is London—its squares, its parks, its churchyards, and its suburban gardens and roads—those more particularly which are planted with lime (linden) or poplar trees. Here it has become almost domesticated, and seems to have lost in some degree its more natural characteristics—as, for instance, in the country its male may sometimes be taken on a warm spring evening flying wildly and vigorously to a strong light—all the specimens which I ever met with in South Wales were taken in this manner—but in London such a habit seems to have become lost, or very nearly so; it is a rare circumstance to

see a specimen on a lamp, but nothing unusual to see the insect night after night actually sitting upon a tree, by the light of a street lamp, of which, nevertheless, it takes no notice. This habit of sitting for days and nights on the same tree, without moving, extends to both sexes, and, indeed, in a special degree to the female, which—probably after depositing its eggs—has been found alive in precisely the same spot, on a tree trunk, for ten successive days! and not in exceptionally cold or wet weather, but during wet and dry, warm and cold alike, while life lasted. As it sits its wings are quite deflected or roofed, the fore wings concealing the hind. Although quite common in London, and to be seen as one walks about the more suitable streets, and in some years very abundant, it appears never to be very common in the country districts, yet may occasionally be taken throughout the South of England with the Eastern Counties, and it is said to be now common in the gardens of the City of Norwich; it has also been taken at Rugeley, Staffordshire, and very rarely in Yorkshire, Westmoreland, and Cumberland. In Wales I have several times taken it at Pembroke, as already remarked upon. In Scotland it is found occasionally in the south-west to Clydesdale, and also in Perthshire; in Ireland in Wicklow, Westmeath, Cavan, Galway, and Sligo. Abroad throughout Central Europe, the temperate regions of Northern Europe, Central and Northern Italy, Corsica, the Balkan States, and Southern and Eastern Russia.

2. **B. prodromarius**, *Schiff.*; **stratarius**, *Staud. Cat.*—  
Expanse  $1\frac{3}{4}$  to  $2\frac{1}{4}$  inches. Thorax robust, black-brown and white; fore wings white dotted with black spots, and having two chocolate-brown bands, edged with black. Hind wings dusky-white dusted with black.

Antennæ of the male strongly pectinated, to the tips, with long, nearly straight, ciliated teeth, reddish-brown, shaft spotted with white; palpi short and blunt, depressed, black-brown; head rough and strongly tufted, creamy-white; collar

similar, dotted in front and edged behind with black; shoulder lappets of the same colour, obscurely barred with black; behind each is a broad black stripe, and between them, edged with black, a pair of white tufts behind the collar, followed by a pale purplish-brown dorsal blotch, and then two small black crest-tufts tipped with white; the black area on each side of this is blotched with white; all these rich markings are upon a mass of raised and tufted scales upon the very broad thorax; abdomen moderately stout, glistening yellowish red, paler behind; anal tuft similar, mixed with black-brown. Fore wings very long; costa gently arched at the base and beyond the middle, straighter between; apex fully rounded; hind margin very oblique, gently rounded; dorsal margin strongly ciliated and rather full; colour creamy-white, dusted and dotted with black; first line erect, deep black, throwing off short streaks on the nervures, but inwardly broadly bordered by a pale chocolate band which is much broader on the dorsal margin; second line oblique and repeatedly angulated, deep black and rather blotched, edged outwardly by a broad parallel pale chocolate band; basal area and the broad central space much dotted with black, and in the latter is a cloudy black blotch on the costal margin, which throws off streaks indicating a central shade or stripe, and this becomes again black upon the dorsal margin; the pale space outside the second chocolate stripe is even more clouded with a dusting of chocolate-black; cilia dull black, regularly interrupted with white. Hind wings rather small and a little squared on each side; but slightly rounded behind; creamy-white, abundantly speckled with purple-brown or black; the basal portion covered with long downy smoky-brown scales; before the middle is a similar transverse stripe, and beyond it another, edged outwardly by a faint pale chocolate band; cilia white, dusted and spotted with chocolate. Female very similar, but larger, antennæ simple, black, dotted with white; abdomen very thick, and sprinkled with white and black.

Underside rather similar to the upper, the ground colour of a more dull white, and the stripes dull pale purple. Body purplish-brown; leg tufts large and loose, smoky-brown; legs purple-brown barred with white.

Variable in the degree of black dotting upon the white ground; where this is deficient the markings are often rich, and contrast well with the whiter ground colour; also the positions of the first and second transverse lines are exceedingly unstable, they often approach each other or even coalesce upon the dorsal margin, and not unfrequently so completely amalgamate in the dorsal half of the wings that the two chocolate bands run together, and are so much broadened as to occupy a very large portion of the wing-surface. Rarely this tendency is carried still further; Dr. Mason has a specimen with the fore wings entirely black except a few white dots in the middle; hind wings also blackened; Mr. S. J. Capper another, having the white dotting nearer the costa, and the black clouding very intense, while a specimen in Mr. S. Webb's collection has the basal and hinder area both broadly chocolate-black and the central area blackened with excessive dusting; here also is a specimen with quite the opposite tendency, the basal, central and hinder areas being white with but little black dusting and the bands richly chocolate and black. The Rev. J. Greene has one in which the chocolate bands are spread and greatly diffused.

On the wing in March and April, but occasionally as early as the end of February, or so late as the beginning of May.

LARVA. Head as wide as the anterior segments of the body, prone; the face flat, with a depression in the middle; the crown with a wide and very conspicuous but not very deep notch; body irregularly covered with raised points, or shagreened, and having numerous wart-like protuberances; these are arranged in transverse pairs; the two on the back of the second segment rather distant; one on each side of the



fifth, eighth, and ninth segments, the last large and very conspicuous; two smaller ones on the back of the twelfth segment; and two approximate and indistinct ones on the ventral surface of the seventh, eighth and ninth segments; head reddish-brown; body grey, marbled with various darker shades, the variety sometimes very pleasing and greatly resembling cortical lichens; the summits of the dorsal and lateral protuberances reddish-brown; ventral surface nearly of the same colour as the back except between the ventral and anal prolegs, where it is pale glaucous-green; legs reddish-brown; ventral prolegs grey; anal prolegs and flap reddish-brown. (E. Newman.) Mr. Buckler's figures represent specimens of which the ground colour is purplish-brown, lilac-brown, or very pale brownish drab. This larva, from colour and the shape of its protuberances, is strikingly imitative of a twig of oak.

May, June, and July, on oak, birch, blackthorn, plum, lime, elm, maple, rose, and even garden currant; feeding at night, but remaining upon the branch during the day.

PUPA shining, black-brown with paler segments, and a spindle-shaped cremaster furnished with a stiff pair of outwardly hooked spikes. (Dr. Hofmann.) Not more fully described. In a friable earthen cocoon underground, or under moss, often at the foot of a tree. In this condition through the winter.

The egg is laid deep down in a crevice of the bark of an oak or other tree.

The moth usually sits during the day low down upon the trunk of a tree, or on a paling, or fence, or other projection close to the ground, with wings set rather broadly out, the fore and hind away from the body; and is then quite sluggish, not to be induced by any means to fly. At dusk it flies freely and vigorously, and at night the male is somewhat attracted by a strong light. Never very abundant; though said sometimes to be common in South Devon; usually con-

fined to woods and districts with plenty of scattered trees, and in such suitable places to be found almost everywhere in the South, East and West of England, and more rarely in the Midlands; more frequently in Cheshire, Lancashire and Yorkshire, Westmoreland, and Cumberland; probably also throughout Wales, since I find it recorded in North Wales and Glamorganshire, and have taken it very uncommonly in Pembrokeshire. In Scotland there appears to be but a single record—from Thornhill near Dumfries; in Ireland it is very rare, two specimens have certainly been obtained in the County Wicklow; and Mr. Kane adds Mallow, Cork. Abroad it is found throughout Central Europe, Northern Italy and Southern and Eastern Russia.

3. **B. betularius**, *L.*—Expanse  $1\frac{3}{4}$  to  $2\frac{1}{2}$  inches. Very robust; body and wings white, all abundantly dusted (or peppered) all over with black, usually having black transverse lines on the fore wings, and the costa spotted with black.

Antennæ pectinated with stout ciliated teeth to three-fourths their length, thence simple, brown-black, back of the shaft white; palpi short, porrected, but much concealed by the erect hair-scales of the face, black; lower portion of the face brown-black; upper portion and head white, rough, the raised scales disposed in two tufts, divided by a channel between the antennæ; collar white, faintly barred with black dotting, but edged at the back with black; thorax densely covered with raised, loose, soft scales, white dusted with black, and the slight tufts at the back tipped with black; abdomen moderately thick but tapering, greyish-white, much dotted with black; lateral and anal tufts more blackened. Fore wings long, the costal region especially lengthened; costa arched toward the tip and faintly so throughout; apex decidedly rounded; hind margin very oblique, unusually long and hardly rounded; anal angle distinct though obtuse; dorsal margin ciliated, almost straight; colour white, abundantly dusted with black (as though peppered, whence

arises its common English name); on the costal margin are five black spots; the first and second originate a duplicate angulated black first line, much obscured by the black dusting; the third is attached to a black lunate discal spot; the fourth originates the second line, which is slender and usually obscure, and bends backwards and forwards in large obtuse ill-formed angles; and the fifth, which is large and clouded, seems to edge the beginning of a faint slender white subterminal line, which in its course is further bordered by other black clouds, usually much smaller; extreme hind margin ornamented with a regular series of black dots, or spots, which extend out through the white cilia. Hind wings small, rounded and crenulated behind; white, especially so in the costal area, faintly clouded beyond this with grey, and dusted, or spotted, in moderation, with black; having often two or three obscure partial transverse lines formed of aggregations of this dusting or dotting, most distinct near the dorsal margin; of these the most noticeable runs into the anal angle; central spot black; sometimes followed by a sharply marked and angulated black transverse line; cilia white, spotted between the crenulations with black. Female usually larger, often considerably so; antennæ simple, black spotted with white; thorax and abdomen much more robust; wings more ample and often with the markings stronger.

Underside of all the wings white, with the costal spots distinctly reproduced, but the lines and dusting fainter; on the hind wings is a black spot on the front margin pointing down toward a thin black central streak. Body greyish-white, mottled with black; leg tufts brownish-grey; tarsi black, barred with white.

Variation in this species is great, and on different lines. In the typical race or races it tends towards extinction of all definite markings, leaving the whole white surface but scantily dusted with black, most distinctly so toward the margins;—in Mr. F. J. Hanbury's collection is a specimen almost white, the markings and dusting faint and nearly

absent;—or else the dusting and spotting is increased in various degrees, sometimes on the fore wings only, often on the hind also, and at the same time the transverse lines of all the wings, which ordinarily are obscure, come out with great sharpness and angularity, and indeed *absence* of grace.

About another line of variation there is some perplexity. In it all the usually black markings and dottings are yellowish-brown; and the perplexity arises from the circumstance that this colour can be produced, in this species, with great ease by exposure to the fumes of chlorine. Under this treatment every black marking soon becomes pale brown; and there has been doubt whether some of the varieties known have not been so produced. Yet it is positively asserted of some specimens that they were captured, or reared, of this colour, and I have seen one of quite a different hue, but yet with a distinct tinge of brown, which was taken at Hawick by Mr. J. G. Gordon. It is distinctly stated in the *Entomologist*, 1889, that this form—called there the buff variety—was reared at Manchester, by local collectors, in considerable numbers between 1874 and 1880, and that then the strain died out, and this statement is in accordance with that published in *Science Gossip*, 1878, by the captor of the first specimen.

Very different has been the fortune of a still more striking variety, a form in which the ground colour of the fore wings, and of the greater part of the hind wings, has changed completely from white to smoky-black; while the markings—the transverse lines, the deep black spots, clouds, and dusting—have totally disappeared, the fore wings having become smooth smoky-black, with the nervures deep black; and the hind wings paler smoky-black, or smoky-grey, with frequently, though not always, some white towards the front margin; the thorax and abdomen also have become black, and in some instances the only white portion remaining is the face, or its lower portion, and a round clear white spot at the extreme base of the costa of the fore wings; in other specimens this spot also is absent, and the face or its lower portion, or even

only a tuft at the base of each antenna remains white. As yet I have no knowledge of an *absolutely* black specimen. The history of this black race is of unusual interest. The first example seems to have been seen somewhere about the year 1848, certainly before 1850, but accurate details have not been preserved. In 1865 Mr. R. S. Edleston, of Manchester, wrote in the *Entomologist*, "some sixteen years ago the 'negro' aberration of this species was almost unknown," and in 1886 Mr. Joseph Chappell, of Manchester, an old and well-known collector, only recently deceased, wrote in the same magazine, "In my early days the black variety was almost unknown. I think Mr. Edleston purchased the first I heard of. In the Manchester district the species has gradually altered in colour from light to dark during the last forty years." In 1860 Mr. Noah Greening, of Warrington, captured a pair, of which the female was normal, but the male black; from these he reared the next year about equal numbers of each colour; and by pairing black specimens, in the year after, a very large proportion of black. At this time a great impulse seems to have been given, in this melanic direction, out of doors, and the black variety spread over Lancashire and South Yorkshire; and also to Delamere Forest, Cheshire; in a few more years it had reached Derbyshire, Staffordshire, Leicestershire, Monmouthshire and Lincolnshire. The first black specimen noticed on Cannock Chase, Staffordshire, was taken in 1878; *all* found there are, Dr. Frere informs me, now black; yet in the lower ground, within a mile or two of these hills, the normal peppered form of the species still maintains itself. From a batch of pupæ sent me about 1885, by Mr. Hill, of Little Eaton, Derbyshire, I reared black specimens and very pale normal individuals in about equal numbers. Dr. F. D. Wheeler tells me that about 1870 the two forms were about equal in numbers at Newport, Monmouth, and that a few years later the typical form had almost vanished from that district; a similar statement is made by Mr. R. Newstead, of the Museum at Chester, to the

effect that out of dozens of pupæ collected in recent years none but black have been obtained; by Mr. G. T. Porritt, as to Huddersfield, where all the specimens now appear to be of the black variety; and now by the Rev. A. Thornley, who tells me that on the borders of Nottinghamshire and Lincolnshire dark or black specimens only have come under his notice for the last fourteen years. In some parts of Yorkshire and the adjoining counties, and in the Midlands, the two forms seem still to occur in tolerably equal numbers. On the other hand, I hear that the typical insect still prevails in Cumberland. The black form seems to have reached Berkshire rather early—about 1885—but the first record that I find in Cambridgeshire is for 1892, Norfolk 1893, Suffolk 1896, and London 1897. About the same time it appears to have reached the New Forest, Hants, but it is still scarce in the South of England. In Scotland, so far as is known, it has not yet been observed; and in Ireland very rarely. But upon the Continent it has made extraordinary progress; Dr. August Hofmann says that in 1884 it appeared near Hanover; before 1888 in the Netherlands and Thuringia; and in the next few years in various parts of the Rhine Valley; indeed, he thinks that its progress was up the Rhine. Further information shows its general diffusion in the Netherlands and also in Saxony, Silesia, and other parts of Germany.

This melanic form is itself in some degree variable; as already remarked, the hind wings have sometimes the front margin white, and even peppered; the fore wings also are occasionally a little dusted with white, or there is a small indication of a white subterminal line; and Mr. Sydney Webb has one which shows a deeper black subterminal stripe. Also there is sometimes a tendency to increased size. Mr. G. T. Porritt writes me: "Judging from size, melanism seems to conduce to vigour, for I never remember seeing such enormous specimens as some of these are; a female looks nearly as big as a poplar hawk!"

There still remains another form to be noticed. When the



black variety began to be reared, and obtained in greater numbers, there appeared also an intermediate form, the ground colour white, or greyish-white, but so much obscured by spreading of the normal markings and spots into blotches and clouds that it was almost obliterated. This "mulatto" form, in greater or less intensity, seems at first to have been as common as the black; yet more recently, with the increase in numbers of the latter, it has almost disappeared, or has become comparatively rare, being apparently absorbed by the black race. Even where the black insect has been intentionally paired with the normal, the produce has often been divided between the two extreme forms, without a single specimen of the intermediate. Yet the latter still occurs out of doors. I saw, a few weeks ago, a boxful of specimens of this species, one hundred and eighty in number, which had been taken by Mr. J. Arkle at an electric light at Chester. Of these, one hundred and fifty were black, twenty-four normal, and six intermediate.

A male specimen which scarcely falls into any of these lines of variation exists in Dr. Mason's collection; it has the thorax and abdomen broadly black, and very large black clouds along the costa of the fore wings; moreover one of its antennæ is darker than the other.

On the wing in May and June, and sometimes even till the middle of July; but it has been taken as early as the end of March.

LARVA twiglike; slightly enlarged at each extremity; there are two lateral projections on the ninth segment, two dorsal on the twelfth, and on the thirteenth two small projecting points; also small ventral warts on the seventh, eighth and ninth segments, appearing largest when the larva is half-grown; edges of the sides between the prolegs fringed with small whitish bristles; head large, strikingly bifid, ferruginous at the sides and back; face truncate and indented, ochreous, shaded with ferruginous; body variable in colour,

resembling a birch twig; purplish-slate, dull purple, purplish-chocolate dusted with white; yellowish-brown, dull green, or brownish-green; the budlike lateral projections on the ninth segment generally paler, but sometimes darker; the small dorsal eminences on the twelfth segment often ochreous; frequently there is a row of pale subdorsal spots. In the green varieties each segment is transversely shaded with reddish; undersurface irregularly and faintly streaked with dull orange, in some examples having orange ventral diamonds; spiracles bright brownish-red, often with ochreous blotches immediately above them. (C. Fenn.)

July to September on birch, oak, saw, blackthorn, plum, elm, rose, beech, apple, pear, alder, willow, poplar, sycamore, bramble and currant; feeding at night. When full grown rather sluggish, if blown or shaken out of a tree, lying for a considerable time as if dead.

This larva has been extensively experimented upon by Professor Poulton as to the connection between its colour and its surroundings. He seems to have conclusively proved that the former is directly influenced by the latter, even to the extent of showing that an actual change in the colour of a larva is produced after its complete seclusion to darker or lighter surroundings, and in accordance therewith, even in so short a period as eight days. Very full details may be found in the "Proceedings of the Entomological Society of London" for 1892. On the other hand, the influences, whatever they may be, which are at work causing blackness in the moth, have apparently no similar effect upon the larva, since Mr. Porritt tells me that in his own neighbourhood, the nursery, or focus, of the black range of variation, the larvæ of this species are of a remarkably pale green!

PUPA robust, stoutest in the middle, tapering off very regularly to the tail; head not prominent, limbs closely packed, and the antennæ not strongly cross-ribbed; wing-covers sculptured with very shallow, faint, incised, irregular

lines, but with longitudinal raised ridges towards the tips; dorsal region rather rugged, and, with the middle bands of the abdominal segments pitted in a faint degree; the hind bands broad and smooth; cremaster broad and short, and rather rough at the base, but its spike thick and tapering off, long, straight, and faintly divided at the tip; whole surface glossy, abdomen very so; deep dark red-brown or nearly black-brown, blackest upon the anal segment; the wing-covers rather tinged with green. In the ground, hardly with any but the most friable cocoon.

In this condition through the winter.

The moth, like its congeners, is sluggish in the daytime, remaining at rest on the base of a tree or of a paling, or hanging to a twig in a hedge or bush, or to any low-growing herbage, with wings laid rather broadly apart from the body, the fore wings covering the hind. At dusk it flies and is rather strongly attracted by light; but, as is the case with very many allied species, takes, so far as is known, no kind of nourishment. Not at all restricted to woods, yet inhabiting them; quite as much attached to hedges and wayside trees, and even gardens where there is any shrubbery. Still to be found in the outskirts of London, and, though never really abundant, fairly common throughout England and Wales; apparently more common in the Midland and North-Western Counties than elsewhere. Also not scarce in the South of Scotland, though, as already remarked, only in normal forms, and found so far as Argyle, Perthshire, Moray, and Aberdeenshire. In Ireland rather widely distributed, and even somewhat common in the North, recorded from near Dublin, Louth, Derry, Armagh, Fermanagh, King's County, Westmeath, Mayo, Sligo, Galway, Kerry, Cork and Wicklow. Abroad its range is extensive through Central Europe, all temperate Northern Europe, Northern Italy, Southern and Eastern Russia, Eastern Siberia, and the Central Asian mountain districts.

Genus 29. **PHIGALIA.**

Antennæ of the male strongly pectinated ; palpi shaggy ; head rough ; thorax rounded, densely scaled ; abdomen short and small, tapering rapidly ; fore wings broadly trigonate, with rounded apex ; thinly scaled ; hind wings very broad and ample. Female apterous.

We have but one species.

1. **P. pilosaria**, *Schiff.* ; **pedaria**, *Staud. Cat.*—Expanse of male  $1\frac{3}{4}$  to 2 inches. Antennæ of the male broadly pectinated ; thorax densely scaled ; abdomen small ; fore wings broad, olive-grey, with obscure darker transverse stripes ; hind wings similar but paler. Female without wings.

Antennæ of the male strongly pectinated with slender thickly ciliated teeth which are broadest in the middle, tapering off to the base and the apex, blackish-brown, shaft whiter ; palpi small, much concealed by masses of black-brown scales ; head rough from abundance of erect olive-brown scales ; thorax rounded, appearing wider than it really is from a covering of very thick, widespread, long scales, olive-brown dusted with black-brown ; abdomen proportionately small, short and tapering, rough, reddish-olive, each segment provided with a slightly raised ridge of black scales on its hinder margin ; lateral and anal tufts very small. Fore wings ample, broadly trigonate, thinly scaled ; costa long and straight ; apex rather suddenly rounded ; hind margin very long, smoothly and gently rounded, as also is the dorsal margin, the latter strongly ciliated ; colour olive-grey dusted with brown and with white ; costa tinged with reddish-brown, interrupted by three or four black costal clouds ; from the first of these arises an obscure cloudy first line, forming black streaks on the principal nervures ; from the second an angulated very irregular central shade ; and from the third the obscure and very devious second line, both formed of faint black clouding with black spots or streaks on the

nervures; from before the apex a faint smoky-black cloudy stripe crosses the wing much more directly, and lies almost parallel with the hind margin; cilia olive-grey faintly spotted along the base with black, and obscurely tipped with white. Hind wings semitransparent, large, elongated, but also broad and rather square behind, with the margin very even; greyish-white, faintly dusted with olive-brown; in the middle is a rather undulating transverse cloudy olive-brown stripe, and near the hind margin another, less distinct but more direct; nervures dusky; cilia long, olive-grey mixed with white. Female apparently wingless, but having minute, hardly visible, wing-stumps with hairy cilia; antennæ simple, dark brown, clouded with white; head and thorax covered with raised olive-brown scales, the latter decidedly crested at the back but not having the mass of long scales of the other sex; abdomen thick at the base, and tapering regularly to a point behind, but the ovipositor not usually exerted; colour red-brown with black-tipped dorsal ridges, anal tuft long and pointed, grey-brown; legs long, slender, devoid of tufts; dark brown, barred with ashy brown. To the uninstructed eye more like a spider than a moth.

Underside of the fore wings of the male smoky-grey, faintly tinged with light brown along the costa, and with olive-grey along the hind margin; hind wings dusky-white, dusted with olive-brown, showing the two transverse stripes of the upper side, and a partial additional one near the base. Body dark red-brown; leg tufts very loose and fluffy, olive-grey; tarsi brown.

This species varies in the intensity of its markings, and also in its general colour, from preponderance of grey, or of brown, or even of yellow dusting; in the Eastern Counties the pale grey seems to predominate, and also in Scotland, where the pale, even whitish, grey is set off by more distinct dark markings. On the other hand a specimen reared from a larva found in South Yorkshire in 1892, by Mr. J. N. Young, is of a beautiful yellow-grey with dark markings;

Mr. S. J. Capper has another with pale markings. An orange-yellow specimen, dull orange taking the place of the usual grey dusting, from the collection of Mr. W. H. Jones, of Farnborough, Warwickshire, was obligingly brought to London for my information by Mr. E. W. Lifton; buff specimens almost devoid of markings have been taken near Hartlepool, Durham; and some from Forres, Moray, are uniformly semitransparent pale brown, with darker nervures, and an almost total absence of transverse markings. These last lead up to a distinct phase of variation—such as already remarked upon in the preceding species—where all the usual markings have become obliterated and the darker colour is concentrated smoothly on the nervures, rendering them conspicuous on a paler ground. Colonel Partridge has obtained from Epping Forest specimens of this form, very pale yellow-grey with the nervures brown; Messrs. Robson and Gardner have found them at Hartlepool of a darker smoky-grey with blacker nervures; a more olive coloured variety seems to exist in Derbyshire; and within the last fifteen years a uniform smoky-black race with deep black nervures has made its appearance in South Yorkshire, and has extended into Lincolnshire, Derbyshire, Leicestershire and Glamorganshire. With it are intermediate specimens of all shades of smoky-grey and semitransparent smoky-black, the nervures black-brown or black; in some the hind wings are scarcely affected, in others they are equally unicolorous and blackened. In South Yorkshire, where it doubtless originated, this range of forms is already becoming more frequent, and forming a reliable fraction of the specimens reared.

On the wing in January, February, and occasionally in March—if the weather is favourable it is often seen on the first of January. In Scotland it appears to emerge earlier still; and casual records exist here of captures at Ipswich on December 14th, and at Bedford on the following day. It is even asserted that in 1887 a specimen was taken in November.



LARVA rugose, warty, much compressed at the sides; head slightly bifid in front, smaller than the second segment, grey-brown; colour purplish-brown, marbled or mottled with ferruginous, particularly on the second and third segments, and at the bases of the usual spots, which are raised into tubercles, each emitting a short black bristle, those tubercles which are on the backs of the fourth, fifth, sixth, and eleventh segments being the most prominent; spiracles white, with blackish margins, and placed in an orange spot; undersurface between the prolegs paler. (C. Fenn.) One of the larvæ figured by Mr. Buckler has white blotches on the sides of the sixth and seventh segments, and the Rev. J. Hellins points out that frequently ochreous streaks in these segments form a V upon the back.

March till May or the beginning of June, on oak, birch, hornbeam, hawthorn, blackthorn, plum, pear, apple, rose, willow, aspen, lime, elm, and wych-elm; feeding at night; remaining during the day on the twigs of the tree, which it closely resembles; very common, very much more so than in the perfect state. The young larva feeds on unopened leaf buds.

PUPA red-brown, with a forked spike on the cremaster. (Dr. Hofmann). Not more fully described. In the earth, usually at the roots of trees. There is said to be considerable mortality at this stage—which extends into the early winter.

The male moth sits during the day on tree-trunks, the stems of bushes, palings, or any convenient object, with the fore wings deflected and much flattened, covering the hind wings and meeting over the body. It is at this time quite sluggish, and may be taken into the hand, cannot be induced to fly, but clings closely to its place, and, if pushed off, falls quite inertly to the ground. At dusk it flies, and is said to be very brisk on moonlight nights, flying about bushes; on dark nights it comes freely to light, and may constantly be

taken at gas lamps if the weather is mild. The female is rarely seen at large; it keeps near the ground during the day, hiding in the angles of bark, where it is not readily seen, and deposits its eggs in the chinks of the bark.

More especially attached to woods, and country districts where trees are plentiful, but also to be found in the outskirts of towns and generally among trees and even bushes; moderately common throughout England and South Wales, probably the northern portion also. In Scotland in the South and throughout the Eastern and Midland districts to Aberdeenshire and Perthshire; but apparently in the West hardly extending beyond the Clyde valley. In Ireland it has been met with in the County of Dublin, in King's County, Westmeath, Galway, Sligo, Fermanagh, Armagh, Antrim and Derry. Abroad it ranges through Central Europe, Southern and Western France. Northern Italy, Sweden, Livonia, and the Ural Mountain district.

### Genus 30. **NYSSIA.**

Antennæ of the male strongly pectinated; palpi shaggy; head rough; thorax stout and shaggy; abdomen thick, but tapering, rough and hairy; fore wings small, narrow, elongated, and with the hind margin very oblique; hind wings small, rounded. Female apterous.

LARVÆ elongate, cylindrical, without prominent protuberances.

PUPÆ subterranean.

We have three species, readily discriminated in the male sex:

A. Wings white, banded and streaked with slate-grey.

*N. zonaria.*

A<sup>2</sup>. Wings nearly transparent, smoky-black, edged with black-brown.

*N. lapponaria.*

- A<sup>3</sup>. Fore wings yellow-grey banded or clouded with black ;  
hind wings smoky-white. *N. hispidaria*.

1. **N. hispidaria**, *Schiff.*—Expanse of male  $1\frac{1}{2}$  inch. Antennæ pectinated, thorax stout, abdomen short, both very fluffy or shaggy ; fore wings narrow, smoky yellowish-grey dusted with darker ; transverse lines black, especially so on nervures ; hind wings smoky-white. Female apterous, black-brown.

Antennæ of the male pectinated with rather short, abundantly ciliated teeth, light yellow-brown ; palpi pointed, black, much hidden among long bristly scales ; head very rough, tawny-brown ; thorax broad, densely and broadly covered with long, loose, soft, raised scales, collar and shoulder-lappets very large, grey-brown or dark tawny-brown, hinder portion blacker ; abdomen rough, every segment edged with long hair-scales, dark red-brown ; lateral and anal tufts extremely shaggy. Fore wings narrow ; costa straight ; apex rounded ; hind margin long, oblique, gently curved ; dorsal margin straight ; colour very pale grey or grey-brown, faintly dusted over with pale yellow, and tinged along the costa with olive ; also more or less generally dusted with black, first line obscurely double, thick, curved, composed of thicker aggregations of the black dusting, and very indefinite ; second line more distinct, thick, oblique, and notched, deep black ; closely followed by a more direct oblique band of similar dusting, which forms a transverse series of points running out along the nervures, and throws a streak into the apex ; beyond this is often the palest portion of the wing—a broad sub-marginal band of the ground-colour—the central area being commonly much filled up with dark dusting ; cilia grey with a black line along the base, and broken by whitish dashes ; or greyish-white spotted with black. Hind wings small, rounded behind ; greyish-white dusted all over with dull brown ; in the middle is a faint transverse clouded smoky-black stripe ; cilia reddish-brown. Female quite

apterous, very hairy; antennæ simple, but thickly ciliated; head and thorax black-brown, covered with raised loose scales, and the latter singularly ridged at the back; abdomen thick, rather tapering, rough, reddish-black or greenish-black, suddenly becoming more smooth and tapering toward the anal extremity; legs long, tibiæ covered sparsely with black-brown hairs; tarsi dark brown.

Underside of the fore wings of the male pale smoky-grey, mottled with greyish-white; costa dotted with black and having a large black cloudy spot beyond the middle, and a brown cloud close to the apex; hind wings white, dusted with brown; a large black spot on the middle of the costal margin originates a sort of transverse cloudy stripe, in the middle of which is another black spot. Body excessively hairy, red-brown; leg tufts very thick, rather paler; tarsi black.

There is considerable diversity in the degree of brown-black clouding in the middle area of the fore wings of the male; often it fills and blackens all that portion, either forming a dark central band, or totally obscuring the transverse lines; specimens from South Yorkshire far exceed in sooty tendency of colour those of the South. Other more casual specimens, along with black or dark brown central clouding, have a white stripe along the hind margin; and in one specimen in Dr. Mason's collection this stripe is yellow; others have the whole of the fore wings grey-brown; and occasional specimens are blackened throughout. A very curious specimen in Mr. S. J. Capper's collection has the fore wings black-brown, except a very pure creamy-white stripe, cut into, regularly, by dark streaks, lying along the hind marginal area, two white blotches on the dorsal margin, and a row of black spots on the extreme hind margin. A specimen reared in London by Mr. Montgomery, from an egg laid by a female from Richmond Park, is nearly white, with the transverse lines and apical streak dark grey, but the middle of the fore wings white and unclouded, with hind

wings white; others in the same batch are unusually white. There is here also an unusual form of variation—the mass of long scales which covers the thorax in the male becoming sometimes so thick and spreading as to resemble a large hood, overhanging the bases of the wings. The female varies from brown to black.

On the wing in February and March.

LARVA rugose, rather bristly, of fairly even breadth, but with every segment rather full and the sides compressed; the usual raised dots distinct, those on the back conspicuous as small dull orange or black warts; head rounded, brown or grey; body black-brown, greenish-brown, or purplish-brown; sometimes short longitudinal black lines appear on the back of the second, third, and fourth segments; often there is a mottling of orange colour on the back and especially on the sides, sometimes white dots on the second and thirteenth segments; legs and prolegs of the colour of the body; undersurface rather paler.

The Rev. J. Hellins, remarking on the extreme similarity of this larva to that of *Phigalia pilosaria*, points out that its dorsal raised spots are not so large or so conspicuous, and that the ochreous V mark often visible on the sixth and seventh segments in *P. pilosaria* is absent in the present species.

April and May, sometimes to the beginning of June, on oak and occasionally on hawthorn, hornbeam, birch, and elm. The leaf-buds of hawthorn form an excellent substitute, in confinement, as food for young larvæ until the oak comes into leaf. Naturally, no doubt they bore into oak buds at this early season. The eggs are laid in some deep chink in the bark of an oak tree.

PUPA shining, red-brown, with a darker cremaster, having on its sides small knobs, and terminated by a weak slender forked spike. (Dr. Hofmann.) In the earth, sometimes at a depth of eighteen inches. As this species is rather difficult to rear I quote some remarks by Mr. Alfred Ficklin. "I had

a large seakale pot in which I placed finely-sifted earth to a depth of at least ten inches, and in this fed up my larvæ. They duly went down, and in the course of the summer somebody knocked down the pot and broke it, when I found that the larvæ had burrowed down to the bottom, their passages still existing and crossing each other in every direction. They had become pupæ in the burrows without making any cocoon." In the *Weekly Entomologist* (1863) Mr. J. B. Blackburn told how he made a journey to the wood whence his larvæ were procured to obtain suitable soil in which they could burrow, and that all those placed with *this* earth went down and became pupæ; but that all those placed upon soil from his own garden, with one exception, refused to burrow, and died on the surface of the earth.

The winter is passed in the pupa state.

The moth sits upon oak trunks in the daytime, especially just after emergence; the female very inconspicuously, near the ground. At dusk the male flies vigorously, and at this time the female also becomes active, running rapidly up the trees. The male flies again between 10 and 11 P.M. and will then come to a strong light. Some specimens of the male, in collections, have the abdomen puffed out rather large, and the anal segment turned under, so that they suggest the appearance of females; and it is doubtless from this circumstance that Donovan, at the beginning of the present century, figured what he supposed to be the female, winged as in the male, but with the pectinations of the antennæ shorter. He also stated that both sexes had been reared by Drury, yet evidently did not know that the female is apterous. I do not know whether this will be held by any one to be evidence of recent degradation of the female in this species!

A very local species; found in oak woods and in parks with plenty of scattered oak trees. Apparently the earliest records of its occurrence in this country were obtained from Lancashire and Yorkshire; but for many years Richmond



Park, Surrey, has been looked upon as its principal locality here. Either it has been somewhat overlooked, as from its habits and early emergence is quite probable, or else it has within the last few years extended its range, for it certainly has been noticed recently in many fresh places. Besides the locality in Surrey just mentioned, where in some seasons it is still rather common, it has been taken in Sussex, rarely in Berks and Wilts, in Devon, Essex, Suffolk, Norfolk rarely, Bucks, Gloucestershire, Herefordshire, Leicestershire, Warwickshire, Derbyshire, North Staffordshire; Dunham Park, Cheshire; Lancashire; near Wakefield, Doncaster, Sheffield and Huddersfield in South Yorkshire; and rarely in Westmoreland. Mr. Robson has just received information of its presence in the Valley of the Derwent, North Durham. I find no reliable record in any other part of the United Kingdom. Abroad it has but a limited range, through considerable portions of Central Europe, and Northern and Central Italy.

2. **N. lapponaria**, *Bdv.*—Expanse of male  $1\frac{1}{2}$  inch, male antennæ pectinated; thorax and abdomen stout, hairy, black; fore wings narrow, semitransparent, edged with smoky black-brown; hind wings similar. Female apterous, black with an orange dorsal line.

Antennæ of the male rather short, loosely pectinated with slender ciliated hair-like teeth, black-brown; palpi concealed by abundant long black projecting hair-scales; head depressed, extremely shaggy, but having a broad orange patch between the antennæ; thorax stout, densely covered and shaggy with long black hair-scales tipped with brownish-white, down the middle is an orange streak, and a fainter patch of the same lies over the base of each fore wing; abdomen very shaggy, the long hairs black, tipped with white; ornamented down the middle of the dorsal region with a row of orange spots; anal tuft rather long. Fore wings narrow, costa nearly straight or even faintly concave

to near the apex, where it becomes a little arched; apex angulated; hind margin oblique, quite evenly curved to round the anal angle; dorsal margin nearly straight; semi-transparent, the surface merely set with isolated smoky-black scales, which are whiter when the light falls on them from toward the base; the costal margin and the nervures black, dusted with orange-yellow; first and second lines oblique, near together, very faint, yet broad, and consisting of closer aggregations of the separated black scales, except that each forms a small black cloudy spot on the dorsal margin; cilia smoky-black with a purplish gloss. Hind wings small, rounded behind; even more nearly transparent, the isolated scales long and grey, but still more thinly distributed and minute; nervures black, dusted with yellow; cross-bar black; cilia smoky-black with a purple gloss. Female apterous, except that two black flaps, dotted with orange and excessively hairy, indicate where the wings should be; antennæ simple but rather notched and ciliated, black, dotted with orange; thorax and abdomen thick and shaggy, black except that the hairs are tipped with white, and that the orange stripe is complete from the face, down the back of thorax and abdomen, to the anal segment; legs black, the tibiæ furnished scantily with hairs like those of the body.

Underside of all the wings of the male apparently devoid of scales, except on all the margins, which are smoky-black, and a few at the discal cross-bar which form a faint spot; nervures hairy, body and legs shaggy, black, with hoary tips to the long scales; tarsi deep black. (Described from specimens furnished for that purpose by Mr. W. M. Christy.)

So far as is yet known, not variable here, but Continental specimens appear to be more thickly furnished with scales of a greyish white colour, the transverse lines or stripes are smoky-black, and additional ones become visible, one at the base, the other toward the hind margin.

On the wing in April and May.

LARVA long and rather slender, smooth and without humps; head pinkish-white, completely irrorated, except the mouth, with minute blackish dots and lines; body pale yellowish-grey, covered with brown-black markings in streaks, and irregularly folded and repeated broken-up lines, which form longitudinal stripes, divided by irregular double dorsal, and single subdorsal and spiracular stripes of bright yellow, irregularly broadened and narrowed, but widest near the hinder edge of each segment; undersurface similar, but with smaller black markings, and paler yellow stripes; legs and prolegs similar. Described from larvæ sent by Mr. W. M. Christy for that purpose. He says that they range in colour from dark purplish-brown to putty colour.

May and June, on birch and hawthorn. Hofmann says larch. Feeding at night.

PUPA short and thick, head and eye-covers rather prominent; leg-covers well ridged, as are the antenna-covers, the latter also showing the cross-bars of the pectinations; wing-covers finely sculptured with abundant ridges and minute furrows, much roughened thereby; abdomen rapidly tapering, each segment plentifully pitted with fine punctures, and not glossy, but the hind band of each smooth and distinct; anal segment very suddenly rounded off, but having a cremaster like a thick short conical spike, tipped with two very small bristles. Whole surface dull red-brown, but the wing-covers faintly paler. In the earth, but apparently without any cocoon.

The male moth appears to be very sluggish, hardly inclined to fly even at night, yet the males have casually been seen flying at almost any time of day, even in sunshine. This refers to specimens reared in captivity in the South, in a climate in which, naturally, the species could not exist. It may also point to a natural day-flying habit in a more northern habitat, where the night in summer is short or absent. Its habits at large have scarcely been noticed. The female lays its eggs

in any deep chink of bark, or in confinement in a folded-up bit of lino or gauze: Mr. Christy records that its ovipositor is quite a quarter of an inch long, and that when alive its body is round and plump, but loses its shape when killed.

On April 20, 1871, Dr. H. Guard Knaggs wrote in the *Entomologists' Monthly Magazine*, "I have just had a very fine male example of *Nyssia lapponaria*, Duponchel, submitted to me for determination. It was, I believe, captured by Mr. Warrington in Perthshire." In 1895 Mr. W. M. Christy, of Emsworth, wrote to me as follows: "I have taken this species myself in Scotland. I do not care to give the locality or even the county of the capture, as I made no secret of my movements." Through his care in this respect the locality of the species still remains, I believe, a secret, and very possibly its extinction may, by this action, have been averted. Mr. Christy has reared it in, I think, several generations, and has liberally supplied it to me, in different stages, as well as to others who were desirous of studying it. In a further note just received, he says, "I have taken it myself in the Highlands of Scotland." Its only *recorded* locality in these islands is Perthshire. Abroad it is known to occur in Lapland, and in the Upper Engadine in East Switzerland.

3. **N. zonaria**, *Schiff.*—Expanse of the male  $1\frac{1}{4}$  inch. Antennæ pectinated; thorax dark grey, striped with white; abdomen barred with pale yellow; wings rather narrow, white, with grey nervures, margins, and oblique transverse stripes. Female sub-apterous; body black, barred with yellow.

Antennæ of the male rather short, strongly pectinated with long, much ciliated teeth, dark grey, back of the shaft white; palpi drooping, thickly covered with projecting hoary-grey hair-scales; head very shaggy, grey-brown, the tips of the erect scales white, and a white tuft under the base of each antenna; thorax fluffy from abundance of soft

upraised scales, grey-brown, striped across the collar, and broadly down each side of the very large and long shoulder-lappets, with dull white; abdomen short, thick, black, very downy, the back of each segment edged with yellow or rusty-orange, and the whole surface shaded with scattered white hair-scales; anal tuft hoary. Fore wings narrow from the base, expanded toward the anal angle; costa faintly concave to near the tip, where it becomes a little arched; apex bluntly rounded; hind margin very long, not very oblique till below the middle, which is faintly elbowed, and from which it curves off with a long sweep right round the wide anal angle; dorsal margin straight; white, with three very oblique transverse slate-grey stripes; the first arising broadly on the dorsal margin near the base, and running inward upon every nervure, tapers off a little as it approaches the costa far beyond the middle; the second is broad throughout but least so at the costa, and parallel with the outer edge of the first; and the third, almost equally broad, lies along the hind margin; nervures grey-black; discal spot a similar slender crescent; costa dusted with the same colour; cilia pale slate-grey dashed or tipped with white. Hind wings narrow and much elongated, rather squared at the apex, and rounded behind; white, with the nervures slate-grey; across the middle is a slender stripe of the same colour, often visible principally upon the nervures; another stripe, broader, of a paler tint of the same colour, or sometimes divided by a white intersecting line, lies along the hind margin; cilia of the same colour. Female nearly apterous, but possessed of four minute useless flaps of wings, black, but fringed with long white hairs; antennæ quite simple; head and thorax black but with abundant white hair-scales; these also are scattered over the abdomen, which otherwise is black, thick, and ovate, the edge of each segment marked by a yellow line; the lower portion of the body is clothed with longer brown hair-scales; legs black, but feet pale brown.

Underside of the wings of the male an accurate reproduc-

tion of the upper, except that a deep black narrow discal streak is conspicuous on all the wings; body covered with shaggy whitish-brown hairs; leg-tufts and legs purplish-brown, the tarsi barred with white.

Not very variable except in intensity of colour, from white with the nervures pale yellow-brown and the stripes exceedingly faint, to a grey ground colour, with strong thickened black markings. The whitest specimens with the brightest markings are obtained from Ireland.

On the wing in March and April.

LARVA even in breadth, almost cylindrical, without protuberances; head rounded, grey, marbled with darker lines; dorsal region green or grey-green, excessively marbled and irrorated with minute grey or grey-black irregular lines and dots, among which the dorsal line, double but equally irregular, is sometimes visible, especially upon the anterior segments; edging this marbled dorsal and subdorsal area on each side is an almost equally irregular black longitudinal line which makes an arch over each spiracle, and also forms the upper margin of a broad bright yellow spiracular stripe, which is again edged below by a greenish-black stripe; undersurface black with two middle stripes of dusky-grey; over each black leg and proleg is a yellow curved streak. There is but little change in the colour and appearance of this larva from its early youth upward.

May till July or August; on sallow, bird's-foot trefoil, dandelion, dock, thistle, plantain, clover, grasses, birch (in confinement), yarrow, *Centaurea*, *Salvia*, knotgrass, and colts-foot; apparently almost any low-growing plants; feeding at night, remaining during the day upon its food in an arched position, holding with both legs and prolegs, but if disturbed dropping by a thread, and remaining suspended, or lying doubled together on the sand.

PUPA short and stout, very thick in the middle, tapering a little at the head, and rapidly at the abdomen; limbs closely



packed and showing as mere ridges; antenna-covers rather dull, broad, flattened, very shallowly sculptured with the form of the pectinations; wing-covers not very glossy, having scarcely any sculpture, but the nervures indicated and the margins rather sharply edged; dorsal and abdominal segments abundantly and coarsely pitted, except upon the hinder band of each, which is smooth; anal segment thick and suddenly rounded off; cremaster a single conical spike; colour dull red. It is curious that the female pupa has the wing-cases as sharply indicated as the male, though thinner and flatter, also it has the broad bars across the antennæ; but its anal spike, in my example, is placed at right angles to the position of the other.

In the sand, without cocoon, so that sometimes it is left bare by the blowing away of the sand.

The winter is passed in this condition.

The moth sits in the daytime upon any herbage in the shelter of tufts of grass, or upon bits of stick or any other rubbish lying upon the sand, and the male cannot easily be induced to fly in the daytime, indeed, will fall down as though dead when touched, yet there are occasions when it buzzes at this period in hot sunshine, or even in windy, showery weather, a few inches above the ground, and has thus been knocked down with an umbrella. About sunset it flies naturally, buzzing swiftly over the same ground in search of the female, which is quite inert and makes no attempt to shelter or conceal itself. The male also flies at night, and has been known to come to a gas-lamp. The eggs are laid in masses, in grass sheaths, and the whole life of the creature is probably spent in a space of a few feet in extent. Consequently it is excessively local, frequenting coast sand-hills, but there only in quite isolated spots in some hollows of the hills, but in these favoured places it is to be found in multitudes, not perhaps in equal abundance every year. There are few species more sluggish; if reared in confinement and

kept alive I have known the males to live for three weeks, without flying or damaging themselves in any way, and at last to die with the cilia of their wings still perfect. This must, I think, be in some cases the result of unsuitable climate, since a quite different account of its habits comes from perfectly reliable observers in the North of Ireland. The Rev. J. Bristowe says that he found male specimens, rather smaller than English examples, "flying from three to four P.M. in the sunshine, in a lively buzzing manner, like a *Procris*, but with a rather heavier flight, about three feet from the ground;" and Mr. C. W. Watts tells how "when they are at rest on the sand they have a queer trick of turning on their backs when approached, and curling their abdomens as though in a threatening manner, which the yellow banding rather enhances."

For many years the one locality for this species has been on the sandy shores of the estuary of the Dee, on the Cheshire and Flintshire side almost to Conway, and on the north side to Wallasey and New Brighton; here it seems to have been discovered about the year 1832, although not recognised as a British species till 1834. For nearly half a century this succession of waste sand-hills appeared to be the sole locality, and from it specimens have been obtained in such plenty that every collector was easily able to place the insect in his cabinet. Curious statements, made in 1844-5 by Mr. J. B. Hodgkinson, did not, as it now appears, receive the attention to which they were entitled: "A friend of mine who lately visited the Isle of Skye observed a great number of the larvæ of a *Geometra*, very similar to those of *Abraças grossulariata*; they were feeding on the burdock on the summit of Ben Beckley, where he shot a rock dove, the crop of which was completely gorged with them. A few of these larvæ have since changed into pupæ. . . . Respecting some larvæ which were found in the Isle of Skye, I learned that a female *Nyssia zonaria* had come out this spring from one of the chrysalides which was uninjured. Now, it is a

question whether this insect is indigenous to the Hebrides or not, and those which have been found at New Brighton, Cheshire, have been originally imported thither among wool, or rushes that have been used to pack up fish with. My friend informs me that the larvæ were in swarms upon the sand-hills of Bernarah and several other islands which he visited." For fifty-five years this statement remained unconfirmed, and, indeed, was discredited by the author of the "List of Lepidoptera of Scotland," and it is only now, in 1899, that Mr. Wm. Evans, of Edinburgh, has received the insect from another island—Tiree, in the Inner Hebrides. It seems possible that the creature belongs naturally to this more northern latitude, and that this may help to explain the failure of the species to establish itself more extensively upon the English coast, where suitable sand-hills are by no means wanting. It is, however, interesting to find that within the last few years it has reached the Lancashire coast, and is now plentiful on the sand-hills of the outskirts of Liverpool towards the sea, sitting on posts and on the plants at the sides of the footpaths; and has also reached Blackpool. About fifteen years ago it was discovered by the Rev. John Bristowe at Ballycastle, Antrim, in the north of Ireland, and is now found to be an inhabitant of the west coast in Connemara, and of Achill Island; moreover, Mr. G. H. Carpenter, of the Dublin Science and Art Museum, informs me that it is abundant near Roundstone, Galway. Abroad it does not seem to be at all restricted to the sea coast, but is found in Northern France, Germany, Switzerland, Hungary. Southern and Western Russia, the Ural Mountain district, and Armenia.

#### Genus 31. **DASYDIA.**

Antennæ simple, thick; palpi small; head rough; thorax narrow, shaggy; abdomen moderately slender, smooth; fore wings silky, long, costa unusually straight, hind margin

very oblique ; hind wings elongated and ample, crenulated behind.

We have but one species.

1. **D. obfuscaria**, *Schiff.*—Expanse  $1\frac{1}{4}$  to  $1\frac{5}{8}$  inch. Body rather slender, fore wings elongate, pointed, glossy dark grey, discal spot black, subterminal line irregular, white ; hind wings glossy dark grey. Female similar.

Antennæ of the male thick, simple, almost naked, light brown ; palpi extremely short and blunt, grey-brown ; face unusually smooth ; head more rough, both dull grey ; a small ridge on the neck is tinged with brown ; thorax narrow, rather shaggy, grey ; abdomen slender and smooth, hoary-grey ; anal tuft pointed. Fore wings much elongated toward the apex ; costa remarkably straight or almost concave, scarcely arched even at the apex, which is bluntly angulated ; hind margin long, oblique, smoothly but very slightly curved ; dorsal margin straight, ciliated ; silky, dark-grey or leaden-grey minutely frosted with white ; first line often obscure, a faint series of darker grey or dull black cloudy spots upon nervures, sometimes joined by very faint cloudy streaks, in which case it is much indented ; second line more noticeable, a cloudy series of thick grey-black crescents, joining blacker spots on the nervures, placed obliquely, and rather gracefully curved ; subterminal line very slender, rippled throughout, or reduced to a series of faint dots, white or greyish-white, edged inwardly with blackish-grey ; discal spot ovate, leaden-black ; cilia grey, mixed with white. Hind wings tolerably ample, quite elongated, crenulated on the rounded hind margin ; of the same shade of silky dark grey, or leaden-grey ; central spot obscure, rounded. grey-black ; immediately beyond, or actually touching it, is a transverse, slender line of grey-black crescents edged outwardly with whitish cloudy dots ; nearer the hind margin is a broader similar stripe, also with external small cloudy white spots ; cilia mixed grey and white. Female a little smaller, with more

slender antennæ; and the fore wings often paler grey or whitish-grey; abdomen shorter and thicker; otherwise similar.

Underside of the fore wings dull pale smoky-grey; costa and nervures faintly tinted with brown; discal spot and second line obscurely perceptible. Hind wings greyish-white, dusted closely with purplish-grey; central spot hardly visible. Body pale grey; legs not tufted, grey-brown.

Variable only in depth of colour; casual specimens of both sexes are considerably blackened; but those obtained in the Hebrides are pale, the females sometimes conspicuously so. A specimen in Dr. Mason's collection is unicolorous shining grey-brown, without markings, but with the nervures faintly darker, fore and hind wings alike.

On the wing in July and August.

LARVA very stout and stiff, cylindrical in the middle, slightly flattened at the extremities; the spiracular region forms a puckered ledge; legs short; head smaller than the second segment, and tucked in; general colour, including the head, grey, in some specimens becoming gradually paler behind; on the front segments a fine double dorsal line encloses a whitish-grey thread, but afterwards this double line appears only as a small elongated spear-head in the middle of each segment; the subdorsal line is a fine waved pale thread, edged with black, and bearing thick dark dashes at the beginning and end of the segments; the tubercular warts are whitish with dark rings, the dorsal pair on the twelfth segment placed close together, and being more developed than the rest, stand up as obtuse points; the warts, in a row on the thirteenth segment above the anal flap, are very small and black in colour; the spiracles are pale brown ringed with black, and are placed in a stripe of dark grey, with darker dashes at the folds, and some fine dark streaks, wavy and sloping upwards; this is followed by a line of whitish-grey which melts into the grey or reddish-

grey of the undersurface, the centre of which is buff, and bears a row of brown dashes down the middle, with five sets of curious curved pairs of streaks on either side of the folds between segments five and ten. (Rev. J. Hellins.)

August or September till June or even July, hibernating while quite small, and recommencing to feed toward the end of March; on heather, or in spring on the young shoots of broom, but in confinement feeding with equal willingness upon knotgrass. Hofmann says on low plants, especially the species of *Vicia* and *Genista*.

PUPA long, shining, yellowish-red; abdomen densely punctured; cremaster broad, wrinkled, tipped with darker colour, finished off with two stiff, brown, short, projecting points; spiracles dark brown, full, and very visible. (Hofmann.) In a slight cocoon just beneath the surface of the earth.

The moth seems in these Islands to be confined to northern heaths and mountain-sides. Here it sits by day with wide-spread wings flat on the surface, on the sheltered sides of rocks, often hiding closely in crevices, and, especially in rainy weather, takes refuge under projections, and squeezes itself close into the rocky interstices. Here it is much protected by its grey colour and close resemblance to the rocks and rock-lichens. So anxious is it for shelter from rough weather that a rock-hole will sometimes contain several specimens, even so much crowded together that wings overlap. If disturbed in warm weather it rushes vigorously away to a short distance, but soon seeks a similar shelter; if the weather be cold it may be boxed where it sits. Where rocks of its own colour are not available it will sit upon suitable stone walls, or even hide among fern. Occasionally it seems to be restless by day, and may then be seen flying lazily about rocky roads, or more swiftly over the heaths. Its natural time of flight is at dusk, when it is strong on the wing, yet seldom cares to fly far from its favourite rocks. Here it yields, however, to the attraction of a strong light.



Its range on the northern heaths and moors is from the sea-level to 1400 feet above. It does not seem ever to have been noticed in England or Wales, or in the extreme South of Scotland; but is common on many of the mountain heaths of Perthshire, Inverness-shire, Aberdeenshire—where it descends to the coast—Kincardineshire, Dumbartonshire, Argyleshire—including Bute and Arran—West Ross, and the Hebrides. In Ireland there is a single record, which appears to be reliable: Mr. G. P. Farran, of Templeogue, Dublin, states that he took one specimen flying on the seashore at Dowros Head, Donegal, and that it is now in the Science and Art Museum, Dublin. Mr. G. H. Carpenter reports that the specimen is a male, correctly identified, but darker than those from Scotland. Abroad it inhabits the Alps, as a somewhat paler variety than ours; also Sweden, Livonia, Finland, and in Asia the great central mountain region.

[*Dasydia torvaria*, *Hüb.*; *tenebraria*, *Esp.*—This is included as a British species in *Humphrey and Westwood's British Moths*, and in *Stainton's Manual*; the latter author merely remarking that “a specimen was taken many years ago at Ballymena, in Ireland, by Mr. Templeton;” but in the former work Professor Westwood says: “Many years ago my friend Templeton showed me a black Geometrideous moth much larger than *M. chacrophyllata*, which he had captured on one of the mountains in Ireland, and of which I at the time made a sketch. I have seen nothing like the insect in any collection which I have examined. I have since ascertained that the insect is the *Cleogen Peletieraria* of Duponchel. A reduced copy of my sketch will appear in the supplemental plates to the new edition of Wood's *Index Entomologicus*.

Every enquiry has been made, without result, as to the fate of this specimen; nothing is known of it by the Curators of the Museums at Dublin and Belfast, or by Mr. W. F. de V. Kane, who is so energetically and thoroughly

working up the Lepidopterous Fauna of Ireland; and there is little reason to hope that it is now in existence. Moreover, Professor Westwood's original sketch has disappeared, and nothing remains as an aid to identification but the figure in a supplementary plate to the second edition of Wood's *Index Entomologicus*. This figure represents an insect with blunt, rather rounded wings, slate-grey, without markings, except that the nervures and margins are black-brown; indeed, without taking into account that it is a *reduced* figure, one would be inclined to guess that it represented one of the black varieties of *Fidonia atomaria*, except that the antennæ are weak and threadlike.

Now the genuine *D. torvaria* = *tenebraria* is a very different insect—more robust, shaped very much as *D. obfuscaria*, of about the same size, and with strongly pectinated antennæ in the male; its ground colour varies from rich umbreous to brown-black; its first and second transverse lines are black, much indented, and often enclose a band darker than the ground colour. To this species the figure in question bears no resemblance whatever. To *Ocogene Pelictieraria* the figure does bear some resemblance in colour, the darker nervures, and absence of other markings, but none whatever in its general shape. Indeed, comparison with both species—Continental examples of which now, fortunately, exist in the National Collection, and agree with published figures—induces a belief that Mr. Templeton's specimen was only named by guess in either case, or from very inadequate descriptions, and that it has nothing to do with either species. What the Ballymena insect may have been will, perhaps, always remain a problem; one can only suggest that it was a black variety of some common and well-known species. Certainly *Dasydia torvaria* = *tenebraria* has no claim to a place in the British Fauna—nor has *Ocogene Pelictieraria*.]

[**Mniophila cineraria**, Hüb.—This insect seems first to have been included in the British Fauna by Mr. Doubleday,

who published it in his Catalogue. Mr. Stainton says of it in his *Manual*, "once at Tenby, South Wales," and further, in the *Entomologists' Annual*, 1855, where he calls it *Tephronia corticaria*, "a specimen is in the collection of the British Museum, ticketed by Dr. Leach as having been taken by him at Tenby."

This specimen happily is still in the National Collection, in the cabinet of the late Mr. J. F. Stephens, in good condition, and well cared for; but it is not *M. cineraria* = *T. corticaria* at all, but *Tephronia cremiaria*, an inhabitant of the Tyrol and of some of the mountains of the South of Europe, and a species utterly unlikely to occur on the coast of South Wales. If it was really taken at Tenby, the only probable explanation would be its accidental introduction among alpine plants or by some similar means, but it is far more likely that some accidental transposition of European and British insects took place. Clearly *M. cineraria* has no claim to a place in our Fauna, and I do not propose to introduce *Tephronia cremiaria* upon the evidence here obtained.]

### Genus 32. GNOPHOS.

Antennæ simple; palpi small; head rather rough; thorax slender, roughened with long scales; abdomen slender, smooth; fore wings broad, blunt, and short, with crenulated hind margin; hind wings rounded, with the hind margin deeply and strongly toothed.

We have but one species.

1. *G. obscurata*, *Schiff.*—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Slender, fore and hind wings broad, crenulated behind; grey, dusted with darker; transverse lines, when visible, placed in series of black crescents, and rather erect; in the middle of each wing is a small black ring-spot.

Antennæ of the male simple, thick, almost naked, grey-brown; palpi very small, blunt, grey-brown; eyes black,

prominent; face smooth and rounded, purple-brown, edged above by a whitish transverse line beneath the antennæ; top of the head grey, rough; thorax narrow, covered with long scales, but not very rough, grey or grey-black; abdomen slender, smooth, dark grey; lateral and anal tufts small. Fore wings broad and short; costa gently arched; apex angulated; hind margin beneath it perpendicular, curved off below, decidedly crenulated; dorsal margin a little rounded; colour grey dusted with smoky-black: first line slender, curved, and much rippled, black; second line not very oblique, slender, slightly curved, and disposed throughout in crescents, black; area beyond it often more densely dusted with dull black but divided by a slender, irregular, white-grey subterminal line; discal spot cloudy, somewhat annular, dull black; cilia slate-grey. Hind wings rounded behind, the margin deeply notched into incisions deeper than scallops, separated by very strong crenulations; of the same colour as the fore wings; central spot a cloudy black ring; just beyond it is a rippled slender black transverse line following on from the second line of the fore wings; cilia pale grey. Female very similar but a little stouter.

Underside of the fore wings dull pale leaden-grey, darker towards the margins; hind wings whitish-grey with darker dusting and the central spot and transverse line just perceptible. Body and legs dark grey.

Exceedingly variable, and mainly in the direction of local or racial forms. In the New Forest and sometimes on other heaths in the South of England a form darker than is above described is found in some plenty, and very constant in the blackness of its dusting and markings; further west, in Dorset, Somerset, and adjoining counties, is a race in which a decided tinge of brown modifies the general grey or black; while on the chalk hills of Kent, Sussex, and Surrey, and especially on the adjoining coast, various admixtures of white modify the grey and often soften the markings; until around Lewes, Sussex, and in some other chalky localities, a most

lovely white form is reached, having none of the usual dusting of dark colour, but with the transverse markings clear and well defined in the most exquisite lace-like pattern. Taking another direction of variation, specimens from the far west, especially from the Welsh coast, are uniformly of a far more smooth uniform slate-grey or even slate-brown, the markings less distinct and hardly blackened, the black dusting merged in the uniform ground colour; this form is larger in expanse, and has very ample wings, which also are more shining. These seem to be the principal forms of local occurrence. The names of *pullata*, *serotinaria*, and *dilucidaria*, have been rather freely applied to them, but these are the names of species well known on the Continent, not existing in these Islands, and since these were *variously* applied, and always erroneously, they should be totally disregarded here—except to point out that even so recently as the date of publication of the *Manual* (1859) the whiter forms were looked upon as a distinct species, and called *G. pullata*. All the varieties are united by intermediates—usually from other localities; among the grey-white forms some of those from Folkestone have the central area of the fore wings most exquisitely irrorated with black scales, much intensifying its colour; others take somewhat similar ranges of colouring, paler or darker; occasionally also these are nearly devoid of markings. Specimens from Penmaenmaur, North Wales, are sometimes beautifully dusted with olive-brown, or olive-grey, so much so as to obscure the markings. From the Cheshire coast are occasionally obtained specimens of a reddish-grey. Although the range of regular variation is so large, casual aberrations are very rarely met with, but in the collection of the late Mr. F. Bond is one wholly shining greyish-white with scarcely a trace of dark scales or markings.

It is interesting to observe the suitability of the varying tints on this species to the soil or rocks upon which the different varieties exist—the whitest upon chalky ground,

the blackest upon heaths where the soil is more or less peaty, and the smooth grey upon the limestones of the west; the more so since the effort to influence colour in this species by its surroundings in an artificial manner has hitherto totally failed. Professor Poulton in the course of his experiments fed up a portion of his larvæ among surroundings consisting of white paper and lumps of chalk, and others among black paper and lumps of coal, but no difference whatever was observable in the colour of the resulting specimens.

On the wing in July and August.

LARVA rather short and stumpy, a little flattened beneath, and having a projecting lateral ridge or edge, set with raised points, from between which incised lines cross the body, dividing each segment into a broad raised front band and several narrow divisions behind it; head rather flattened in front, pale greyish-brown, mottled with dusky brown; dorsal region black-brown or grey-brown abundantly dusted with black; all the usual raised dots erected into points, tipped with white; on the thirteenth segment is a pair of grey tubercles tipped with white; outside these the hinder segments are much paler; undersurface, legs, and prolegs purplish-brown; and often there is a broad, central, sharply definite, grey-black abdominal stripe. (From larvæ furnished by Mr. F. C. Woodforde.)

September to May on *Helianthemum vulgare*, *Potentilla reptans*, *P. fragariastrum*, *Poterium sanguisorba*, *Geranium lucidum*, and other low-growing plants; in confinement upon strawberry, chickweed, plantain, and even hawthorn; feeding at night, hiding during the day under the leaves or branches of its food-plant in a very awkward, stiff position, lying on its back or side with its head down and legs drawn together. If it moves at all at this time it is only to take hold with its prolegs, and shiver a little from side to side.

PUPA not very stout, smooth and glossy, limb and antennae-cases very closely packed and hardly having a trace of sculp-



ture; wing-covers rather more dull than the remaining surface, yet with scarcely perceptible sculpture; anterior portion of the segments minutely pitted, but the smooth shining hinder band unusually wide; anal segment very bluntly rounded; cremaster rather flat, springing directly from the smooth portion, broad, and tapering very gracefully to a sharp point, from which arise two minute bristles; colour wholly red-brown. In the earth.

The moth sits during the day on rocks, especially under overhanging ledges, or among any growth of furze or other plants which overhang; or in quarries, especially any holes therein which furnish shelter—indeed, I have seen a dozen specimens at a time sitting closely crowded together under the roof of a quarryman's tool-hole—but where rocks are absent it will sit, sometimes in abundance, on the sheltered side of a peat or turf stack, among the protruding heath sticks, or under the ledges; or even, where this kind of shelter is unobtainable, in cart tracks and gravel-pits on heaths, or among heather, or the rough plants growing on a hillside. From any of these shelters it is readily disturbed, but only flies a short distance, to some similar hiding-place. Its natural flight is at dusk and during the night; it has been known then to frequent the blossoms of clematis, and is in some degree attracted by light. Its favourite haunts are rocky sea-coasts, chalk and limestone hills, and extensive heaths, but inland it is certainly a very local species; sometimes common in Kent, Surrey, Sussex, Hants, Dorset, Devon, Cornwall, Somerset, and Berks; in Gloucestershire on the mountain limestone, also in Worcestershire and Herefordshire; scarce in Norfolk, Suffolk, and Essex; apparently absent from the Midland Counties; and found only on or near the coast in Cheshire, Lancashire, Yorkshire, Durham, Northumberland, and Westmoreland. In Wales common on many parts of the coast, and found also on the mountains. In Scotland common in many places on the east coast, as at

Eymouth, North Berwick, Arthur's Seat, and elsewhere near Edinburgh, the Fife coast, and Muchalls near Aberdeen; westward at Wigtown, and in Argyleshire; also inland in Perthshire, where it frequents rocks in the higher parts of the hills; probably more generally distributed, since Dr. Buchanan White gives its range as extending to Moray and Ross. In Ireland it is found upon the coast generally, but has been very little noticed inland, except that a pale unicolorous dusky grey variety is taken near Athlone. The tendency of variation at Carlingford Lough, and in the North of Ireland, is toward the whitish-grey forms of the Southern English coast.

Abroad its range is through the greater portion of Central Europe, Italy, Dalmatia, Livonia, Finland, and Asia Minor.

### Genus 33. **CLEORA.**

Antennæ of the male pectinated; palpi very small; head rather rough; thorax very slender, roughened with long scales; abdomen slender, moderately smooth; fore wings somewhat ovate, faintly crenulated; hind wings rounded and scalloped behind.

LARVÆ smooth, or furnished with several dorsal humps; feeding mainly on lichens.

PUPÆ in a slight cocoon among moss or lichen.

We have three species, not difficult of recognition:

- A. Fore wings greyish-green, mottled or clouded with black. *C. lichenaria.*
- A.<sup>2</sup> Fore wings greenish-white, with conspicuous black costal spots. *C. glabraria.*
- A.<sup>3</sup>. Fore wings white, with rippled black transverse stripes. *C. viduaria.*

1. **C. lichenaria**, *Schiff.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{8}$  inch. Pale greyish-green, marbled with olive-brown, and faintly with

orange; fore wings with two, and hind with one, slender transverse indented black line.

Antennæ of the male pectinated to the tip, teeth long, solid, thickly ciliated, dull dark brown, shaft whiter; palpi very small; head rough, greyish-brown; thorax slender, not very rough, olive-brown; abdomen rather smooth, slender, whitish-brown; lateral tufts hardly perceptible; anal tuft small. Fore wings slightly elongated; costa very faintly arched; apex bluntly rounded; hind margin regularly curved and most minutely crenulated; dorsal margin also a little rounded; colour greenish-grey or pale olive-brown, clouded with dark olive-brown or black, the base especially dusted with black; first line curved, nearly erect, black, and throwing out a black dash on each nervure; second line black, thickened on the nervures, curved strongly outward, and back, and disposed throughout in crescents, at the costa thickened; partly edged on the outer side with white clouding; discal spot black, rather ovate, obscured by an olive-brown cloud; hind margin clouded with olive-brown, and edged by a row of black dots; cilia white, dashed with smoky-black, and clouded with olive-brown. Hind wings rounded behind, scalloped and crenulated; dusky white, clouded and stippled with olive-brown, more especially toward the hind margin, but in some degree also near the base; just beyond the middle is a transverse black line disposed in crescents and sharp angles; central spot obscure, smoky-black; hind margin dotted with black; cilia pale olive-brown mixed with white. Antennæ of the female simple; body rather stouter; otherwise similar.

Underside of all the wings dusky white; the fore wings much clouded with smoky-grey or smoky-black; costa repeatedly barred with the same; discal spot smoky-black; second line faintly visible and partly duplicated; central spot of the hind wings smoky-brown, followed at some distance by an obscure slender black transverse line. Body and legs brownish-white; the latter without tufts; tibiae smoky-brown barred with white.

There is some variation in the colour of the fore wings—to greener, greyer, or more smoky, and to a more distinct tinge of orange clouding in the middle between the two lines, but always a close resemblance to the lichens, among which it rests, is maintained. In Mr. Percy M. Bright's collection are very beautiful specimens from the New Forest, some white-grey with hardly a tinge of green, the lines and other markings very slender and faint, others richly black-green, with the transverse lines nearly *white*.

Very light and handsomely marked specimens have been taken in the woods of Corsemalzie, Wigtown, by Mr. J. G. Gordon.

On the wing in June and July, but sometimes from the end of May till August; and there is occasionally a casual, very partial, second generation in the beginning of October.

LARVA warty, the spots raised; small dorsal humps on the fifth to the twelfth segments, those on the fifth and ninth the largest; head rounded, pale green spotted with black; body very pale whitish-green, the colour of the lichen on which it feeds; between the protuberances is a row of blackish dorsal spots; usual spots black; spiracular line deep black, much waved, emitting a series of oblique lateral dashes pointing backward; often also with black oblique subdorsal dashes pointing forwards from the second to the seventh segments, most prominent on the fourth; incisions of the undersurface clouded with dark grey; ventral spots black; legs spotted with black.

September till June on lichens, especially those crisp, much branched, grey lichens which grow on old palings and the trunks of trees, also on the fibrous greenish-grey lichens of the trunks of hawthorn, blackthorn, oak, elm, apple and poplar, feeding at night, but remaining during the day among these lichens, admirably concealed by its perfect resemblance thereto.

PUPA slender, antenna-cases prominent and coarsely cross-

furrowed; limb-covers smooth but well marked; wing-cases smooth and only faintly furrowed in the most superficial manner; these portions very glossy pitchy-brown; dorsal and abdominal segments also glossy, red-brown, pitted with small punctures except upon the smooth hind band; anal segment thickened and ridged, darker in colour; cremaster flattened, broad, and tapering off to a pair of strong bristles, hooked in opposite directions, and surrounded by minute curled bristles. In a slight open cocoon among the lichen on which the larva fed.

The moth sits during the day on lichen-covered trunks of trees, and even more frequently on the branches when these latter are shaggy with lichens; from these it is easily dislodged by a blow of a stick, but very commonly it flutters down to the ground like a falling bit of leaf or bark, and if noticed tries to struggle under the fallen leaves; but sometimes, especially if the weather is hot, it will fly to another tree for concealment. It flies naturally at late dusk, and in the night, and will come to light. Almost confined to woods and hedges so dense, or localities so moist, that lichens will grow on the branches or trunks of the trees. In such suitable places common throughout the Southern, Eastern and Western Counties to the Scilly Isles; very rare in the Midlands; recorded once only in Derbyshire; also scarce in Cheshire, Lancashire, Yorkshire, Westmorland and Cumberland. Probably to be found in woods throughout Wales, since I have found it in Pembrokeshire. In Scotland it occurs in the Edinburgh district, Roxburghshire, Ayrshire, Lanark, and Wigtownshire, though not commonly; more rarely in Aberdeenshire, Forfarshire and Ross. Dr. Buchanan White says "to Clyde and Moray." In Ireland Mr. Kane records its wide distribution—Dublin County with the Isle of Lambay, Waterford, Cork, Kerry, Galway, Westmeath, King's County, Sligo, Fermanagh, Monaghan, Tyrone, Armagh, Down, Donegal and Londonderry. Abroad its range extends over

the greater portion of Central Europe, Middle and Northern Italy, Corsica, Greece, Livonia and Sweden.

2. **C. glabraria**, *Hüb.*—Expanse  $1\frac{1}{2}$  inch. All the wings greenish-white, dusted with grey or black; three or four black spots on the costa of the fore wings, one joining the discal spot; on the hind wings one small spot in the middle and one on the dorsal margin; hind margins crenulated, and clouded with black.

Antennæ of the male pectinated with short, solid, ciliated teeth which do not reach the tip, black; palpi small, drooping, dark brown; tongue well developed; head almost smooth, white, crossed beneath the antennæ by a black line; collar and a small ridge in front thereof each white edged with black; remainder of the thorax brownish-white with a black edging to each shoulder-lappet; abdomen slender, dusky-white, barred at the back of each segment with smoky-brown; lateral and anal tufts small. Fore wings rather ovate; costa arched; apex quite rounded; hind margin regularly curved and minutely crenulated; dorsal margin also a little rounded; greenish-white, dusted with grey and faintly shaded with the same, but the extreme base clouded with black; on the costal margin are four distinct black spots, the first marking the first line, which otherwise is often slender and obscure, very little curved, but more distinctly marked upon the nervures; the second unites with the discal spot, which is rather large, deep black, and somewhat ovate; the third marks the position of the usual second line, which when visible is rather direct, a little oblique, and indicated only by black dots upon nervures; the fourth lies before the apex of the wing and is large, rather squared, and sharply cut off by a white subterminal line, which runs in an undulating curve throughout a double series of black clouds filling the hind-marginal region; cilia smoky-black, interrupted with white. Hind wings rounded, crenulated behind; white, dusted with smoky-black, and toward the



hind margin rather clouded with the same; central spot dull black, followed by a slender central curved transverse line of the same colour; hind margin edged and dotted with black; cilia white, clouded with smoky-brown. Antennæ of the female simple. body thicker, otherwise similar.

Underside of the fore wings smoky-white in the middle, clouded with smoky-black toward the hind margin, with yellowish white along the costa; discal spot and a costal spot beyond it dull black. Hind wings white, dusted or stippled with smoky-grey; central spot round, black, followed by a slender stripe composed of the same kind of fine grey markings, which also are rather crowded together toward the hind margin. Body yellowish white; legs white, barred with black.

Usually not variable; but within recent years a tendency has appeared in specimens occurring in the New Forest, Hants, towards general or partial blackening of the wings; in one such specimen in Mr. S. J. Capper's collection the fore wings from the base to the middle are broadly shaded and striped with smoky-black, the lines become deep black stripes, and the hind margin is broadly spotted and banded with black, leaving spots of creamy-white ground colour; the hind wings are shaded over the greater portion with blackish grey. This is a specimen of unusual beauty. Another has a broad band of smoky-black before the middle. These I believe were among the earliest examples of dark variation obtained; similar specimens and all intermediate shades, exist in this and several others of the best collections; Mr. Sydney Webb has some in which the black clouding is around the margins; Mr. P. M. Bright has one in which, along with the dark clouding, the transverse lines have become broad black stripes; while others have only black clouding between the nervures. Taking another line of variation, but from the same locality, a specimen in the collection of the Dublin Science and Art Museum is of a clear greyish-white and devoid of costal spots. On the

other hand, in some unblackened specimens which have just reached me, captured by Mr. A. Elliott in the South of Scotland, the transverse lines are very strongly developed, and almost complete.

On the wing in July and August.

LARVA moderately slender and of about uniform substance throughout; the head a very little less than the second segment and rather flattened in front; segments very well defined; legs developed in gradation, the shortest in front, and the third pair the longest; prolegs well developed. Colour of the head pale greenish-white in front, light glaucous green, reticulated with white, at the sides; near the crown on each lobe is a black streak undulating down to the antennal papillus and bounding the whiter face from the greener side of the head; above the mouth is a triangular mark of blackish-brown atoms; ground colour of the body generally pale blue-green, but on the back is a more lively green tinge, though so pale as to be greenish-white; dorsal line distinguishable by its blue tint; on each side of it in front of each body segment is a small similar streak, but the chief dorsal feature is the row of black spots, one rather oblong spot on the whitest portion of each thoracic segment, on the rest an oblong spot just at the beginning, and another, thicker, shaped like a blunt spear-head, from about midway toward the end of each segment; also a small spot upon the anal tip; subdorsal line a row of black dashes—short on the middle of the thoracic segments, on the rest situated further back—these vary, in some individuals being simple oblong dashes, in others open at one end, again in others at both ends, suggestive of parallel streaks run together in the middle, but in all, each of these dashes is bounded below by a greenish-white dash of the same length, followed by a group of two or three small angular black spots or streaks, and among them the spiracle, blackish, with a faintly flesh-coloured centre; spiracular stripe inflated,

greenish-white, with a black dash at the beginning of each segment, except the anterior ones, which are marked in the middle by a somewhat square spot and a small black spot at the base of each anterior leg; on the undersurface a faint greenish-white central line, with a black elongate mark upon it, at about the middle of each segment from the fifth to the ninth; a little more behind on each side of the central line are twin black specks, and a couple of greenish-white spots on either side at the front of each of these five segments; a very small black mark is at the inside base of each true leg, and these limbs are glistening; usual raised dots excessively small, and dusky, each emitting a fine bristly hair. (W. Buckler.)

August or September till June, on *Usnea barbata* and other shaggy lichens growing upon the trunks or branches of oak, beech, hawthorn, larch, and spruce-fir, feeding especially upon the tips of the lichen-fronds or filaments; feeding only while the lichen is moist and fresh. Mr. Buckler was careful to moisten it with water three times a day, and frequently to change the food.

PUPA half an inch long, slender; eye-covers rather prominent; abdominal divisions deeply cut; anal tip bearing a spike finely forked at its extremity; whole surface glossy; wing-covers olive-green; the other parts brown, except the anal spike, which is blackish. (W. Buckler.) In a small cavity among moss, but so little secured that it will roll out if the moss is handled.

The moth sits during the day in or upon the branches of trees, usually on the low spreading boughs of oak, and is rather sluggish; if beaten out it flies to the ground at a very short distance. Its natural flight is at dusk. Its principal home with us is in the New Forest, Hants, and here it is usually to be found in some numbers; in very favourable years in plenty. I have taken it in Woolmer Forest, in the same county. Elsewhere it is excessively local, and usually

scarce; but it is found in large woods in Dorset, Wilts, Hereford, Devon, and possibly Cornwall. It seems almost incredible that it should not exist in other southern and western English localities, for it has been taken in Cumberland, in Barron Wood, and at Newby Cross; I have myself captured it in Pembrokeshire; and only a few weeks ago I saw a specimen which had been taken at the foot of Snowdon, Wales, by Mr. Birch of Liverpool. In Scotland two specimens, male and female—which have been sent up for inspection—were taken in August 1882 in Minto Woods by Mr. W. G. Guthrie of Hawick. Both specimens are much worn, but the species is unmistakable; and in the present year—1900—eight beautiful examples have been secured by Mr. Adam Elliot in a fir-wood in Roxburghshire. Dr. F. Buchanan White recorded it from the districts of Solway and Clyde, but without particulars. I know of no other records in the United Kingdom. Abroad it is found in Germany, Switzerland, Livonia, Finland, Southern and Eastern Russia, Western China and Japan.

3. *C. viduaria*, Schiff.: *angularia*, Staud. Cat.—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{8}$  inch. Fore wings white, dusted with grey; having a central cloudy grey bar and three or four transverse series of black spots partly connected into lines; hind wings grey-white with spotted margin.

Antennæ of the male pectinated with rather coarse solid ciliated teeth, which do not quite attain the tip, black-brown; tongue long; palpi extremely small, reddish-brown; face smooth, lower portion white, clouded above with black, and the top of the head white with black dots; thorax slender, white, the collar and shoulder-lappets edged with black; abdomen long, slender, white, barred on the basal segments with black, and on the remainder with brown; lateral and anal tufts obscure. Fore wings broad, costa gently arched, apex rounded, hind margin long, hardly curved, but minutely crenulated; anal angle lost in a great curve which includes

the dorsal margin; colour white, slightly dusted with pale brown, and clouded a little with black, especially so toward the base; first line much curved, black, thickened on the costal and dorsal margins; second line but little beyond the middle of the wing, erect close to the dorsal margin, then curved out and recurved, but almost composed of pointed black spots placed upon nervures; between these lines, but suffusing the second, is an erect smoky-black central shade, having at its inner margin three black spots, one each on the costal and dorsal margins, and one half way between; just outside it is an ovate black discal spot; arising from a conspicuous black costal spot, before the apex, is a series of smaller black spots and dots forming the broken inner edge of a white subterminal line, which outside is partly edged with pale brown clouds; extreme hind margin edged with black crescents, dotted at the junctures; cilia white dusted with smoky-black clouding. Hind wings broad, rounded behind and slightly scalloped and crenulated; white, faintly dusted with brown and grey, having three dusky black spots or bars upon the dorsal margin, and the hind margin edged with black lunules: cilia white. Female stouter and having simple antennae, but very similar.

Underside of the fore wings smoky white, clouded in the middle with darker; costa spotted with dark brown, and similar clouds and spots on the hind margin; discal spots black; second line visible, and the other markings more faintly so. Hind wings white, dusted with pale brown; central spot a smoky-black streak, and near it is a similar spot upon the costal margin; hind margin edged with a brown line. Body whitish-brown; legs smoky-black, strongly barred with white.

In the collection of the late Mr. H. Doubleday in Bethnal Green Museum are some fine varieties, some greatly suffused with black, others having the transverse lines unusually blackened. One in the museum at Dublin, obtained from the New Forest, Hants, has the first line thickened into a broad

transverse stripe; and a specimen in Mr. Sydney Webb's collection has the spots of the middle of the fore wings much drawn together. Otherwise this species is rather constant in markings.

On the wing at the end of May and in June.

LARVA rather cylindrical, the second segment broader, with side prominences; from the fifth, each segment has a faint dorsal swelling; sides folded; dull grey-brown or red-brown mixed with paler; head shortly squared, in the middle is a heart-shaped division deeply angulated. (Wilde.)

August and September on lichens upon oak and birch. (Dr. Hofmann.)

PUPA dark red-brown, with a forked hooked spike upon the end of the projection of the anal segment. In a slight cocoon under moss or lichens on the trunk of a tree. (Hofmann.) Apparently the winter is passed in this condition.

The moth is said to sit during the day upon the trunks or branches of trees, much concealed by its close resemblance to a patch of lichen. The late Mr. Samuel Stevens took many specimens in the year 1849 by sweeping the upper branches of oak-trees in the New Forest with a long pole; and the late Mr. G. Baker informed me that it used to sit on the trunks of beeches, as well as of oaks, in that Forest. Here—near Lyndhurst and Brockenhurst—it was not scarce, but about 1872 it suddenly disappeared. The Rev. W. W. Fowler records that at the end of July, or beginning of August, of that year, Mr. George Gulliver, of Brockenhurst, saw an unusual number of examples sitting upon the tree-trunks, but all were females in worn condition. A few days afterwards he could find none, and so far as can be ascertained the insect has not been seen there since. In 1876 and 1877 Mr. W. H. B. Fletcher worked hard for it in that Forest in its former well-known haunts, but could find neither moths nor larvæ. Another locality was Tilgate Forest, Sussex,



toward Wakehurst. but no recent captures have been recorded, and it is feared that this species is lost to the British Isles. One or two casual records in other counties have not been confirmed, and were probably errors. Abroad its range is somewhat limited—the greater portion of Central Europe, Northern Italy, and Sweden.

### Genus 34. **TEPHROSIA.**

Antennæ of the male ciliated in rows of minute bristles, not pectinated; palpi small; head not very smooth; thorax moderately slender, the scales rather roughly raised, bluntly tufted at the back; abdomen smooth, slender; fore wings broad, blunt, gently rounded behind; hind wings ample, rounded, faintly crenulated behind. Legs not tufted.

LARVÆ elongate, somewhat cylindrical, not very conspicuously humped.

PUPÆ of ordinary form; under moss or at the surface of the ground.

We have four species, not difficult of discrimination.

A. A somewhat squared spot outside the second line of fore wings.

B. Wings smoky-white, with black lines and brown blotches. *T. consonaria.*

B.<sup>2</sup> Wings creamy-white or brownish-white, with irregular brown lines. *T. biundularia.*

A.<sup>2</sup> Fore wings without the squared spot.

C. Wings greenish-grey, mottled with black.

*T. cetersaria.*

C.<sup>2</sup> Wings whitish-grey, with black costal bars.

*T. punctularia.*

1. **T. consonaria**, *Hüb.*—Expanse  $1\frac{1}{2}$  to  $1\frac{5}{8}$  inch. Antennæ simple; fore wings smoky-white, dusted with brown;

first line double ; second single, but followed by large brown-black blotches ; hind wings white, rippled towards the anal angle with brown or black.

Antennæ of the male shortly ciliated with bristles, in tufts simulating fine pectinations, brown, the shaft dotted with white ; palpi very small, blunt, red-brown ; tongue well developed ; head rough, white, mottled with purple-brown ; thorax narrow, rather rough, pale-brown, dusted in front and behind with white ; abdomen slender, dusky white, dusted with purple-brown, and barred with pale brown. Fore wings moderately ample ; costa arched at the base and faintly so throughout ; apex rounded ; hind margin gently curved, not very oblique ; dorsal margin rather full and strongly ciliated ; colour smoky-white strongly tinged with dull brown, more smoky in the basal and costal regions ; first line curved, composed of black dusting ; on its inner edge is a parallel smoky-brown clouded stripe ; second line more distinct, moderately oblique and very little indented, black, edged outwardly with pale brown, and followed by two large smoky-brown cloudy spots, one above the middle, squared, the other close to the costa ; beyond these is an irregular sinuous white or white-brown subterminal line, edged on both sides with dull brown clouding ; discal spot a minute black streak, closely followed by another, longer, angulated perpendicular streak, or line, faintly representing the central shade ; hind margin minutely dotted with brown or black ; cilia dull pale brown, often tipped with white. Hind wings broad, rounded behind, and strongly crenulated ; dusky white, dusted with dull brown ; from the dorsal margin are three partial brown or black transverse lines, two of them before the middle and short, the third beyond, more curved and reaching two-thirds across the wing ; this last is edged by a pale brown stripe of the same extent ; along the hind margin is a similar cloudy brown stripe, broken up by dull white spots or angles, and edged at the extreme hind margin by a brown line which undulates, following accurately the edges

of the crenulations; cilia pale brown tipped with white. Female very much brighter in appearance, the dusting of brown being almost absent, the ground colour of the wings white, and the stripes and spots black-brown, with brown clouds between black markings; antennæ simple; body a very little thicker. The squared spot beyond the second line is in this sex very conspicuous, and often the second line itself thick and deep black.

Underside of fore wings white, clouded with smoke-colour; discal streak, and first and second lines, perceptible; hind wings whiter, faintly dusted with grey, central spot a small black streak, followed by a slender transverse line, very faint. Body and legs brownish white; tarsi dark brown, barred with white.

Very little variable, the male hardly at all so, except in the browner or more smoky tinge of the wings; the female in the sharpness and intensity of the markings, and in darkening of the nervures of the fore wings.

On the wing in May and June, but sometimes, in southern localities and forward seasons, at the end of April.

LARVA elongate, transversely wrinkled; sides puckered; two minute dorsal warts on the twelfth segment; head large, rather bifid, flattened in front, dark brown, face whitish-ochreous, barred with dark brown; body yellowish-brown, slightly shaded with grey, especially at the incisions, and in the vicinity of the usual dorsal raised spots; the sides darker and clouded with red; dorsal line broad, ochreous, but lost in the ground colour after the first three or four segments; dorsal raised spots black, those on the twelfth segment elevated into two little tubercles; undersurface very pale yellowish-green. (C. Fenn).

June and July on birch, beech, hornbeam, and oak; feeding at night; remaining during the day upon the twigs of its food-plant, with which it stretches out parallel, holding on with legs and prolegs.

PUPA elongate, pointed, anal extremity provided with a projecting bristle; colour red-brown; wing-cases greenish. Subterranean, enclosed in a delicate, thin, irregularly-shaped cocoon of silk and sand. (C. Fenn.)

In this condition through the winter.

The Rev. Joseph Greene says that this is one of the few species of which the pupa may often be found under moss along the spreading *roots* of trees.

The moth sits during the day upon the upper portions of trunks of trees, or even on branches, and seems to prefer a height of from fifteen to twenty feet. Curiously enough it seems greatly to prefer the trunks of Scotch firs, on which it is sufficiently conspicuous; but will also sit on those of birch, beech, and oak. If disturbed by means of a long switch, it will often flutter lazily down, or go further with the wind to be lost upon the ground, whence it gets up again after a time to return to the trees; but if the weather is hot it will dash rapidly away to settle out of reach elsewhere. The female is almost as lively as the male at this time. The natural flight takes place at dusk, but is seldom observed; doubtless the moths fly rather high and in woods are difficult of observation. It is a very local species, found only in woods, and by no means in all—even large—woods. So far as I am able to judge, it prefers beech-woods on chalk, or woods of birch, oak, and Scotch fir in sand districts. With these limitations it inhabits Kent, Sussex, Surrey, Hants, Dorset, Devon, Cornwall, Gloucestershire, Oxfordshire, Bedfordshire, Buckinghamshire, and Essex, and is rare in Suffolk. There are a very few records for northern counties, which are believed, or known, to be erroneous. In Wales it is found in Glamorganshire; and in Ireland in Cork, Kerry, and King's County. Abroad it has a considerable range through France, Belgium, Germany, Switzerland, Austria, Hungary, Northern Italy, Southern Russia, and Tartary.

2. **T. biundularia**, *Esp.*; **crepuscularia**, *Hüb.*, *Stn.*; **laricaria**, *Stn.*.—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch; second generation  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Body slender; wings ample, white, brownish-white, or greyish-white, dusted more or less with smoky-brown or smoky-grey; beyond the middle of each are two rippled slender black transverse lines, often attended by an outer brown parallel shade.

Antennæ of the male distinctly ciliated with fine tufts of delicate bristles sufficiently long to furnish the appearance of fine pectinations, light brown; palpi whitish-brown; face white, smooth, edged above by a deep channel and beneath it barred with brown; top of the head rough, white tinged with pale brown; thorax narrow, brownish-white, the collar edged, and the shoulder lappets barred with brown; abdomen slender, white, dusted with black; a black-brown bar is placed close to the base; lateral and anal tufts yellowish-white. Fore wings broad; costa arched at the base, faintly so throughout; apex bluntly angulated; hind margin gently curved, not very oblique; dorsal margin rather filled out, or rounded, and ciliated with upraised hair-scales; creamy-white or brownish-white, dusted sparingly with dark brown; first line curved, rather oblique, black-brown, often only distinctly so on the nervures, edged inwardly by a brown shade; second line much more oblique, more distinct, black-brown, undulating and throwing off black points on the nervures. This line is edged outwardly by a yellow-brown stripe, sometimes hardly distinguishable, but containing, almost always, in the middle, a somewhat squared or angulated brown blotch, blackened on the nervures; between the first and second lines is a curved cloudy-brown central shade, arising, as do the two lines, each from a blacker cloud on the costa; discal spot rarely perceptible; beyond the second line and its attendant brown shade is an additional black-brown line or series of clouds in pairs, often black-tipped; closely succeeded by an irregular white subterminal line, again edged outwardly with light brown clouding; extreme hind

margin regularly dotted with black; cilia creamy-white or brownish-white, dashed with brown. Hind wings broad, rounded and strongly crenulated behind; white, dusted with brown, and having three hardly parallel undulating black-brown transverse lines, two near the middle, the first often incomplete, the second distinct, and sometimes having an attendant brown shade or band, the third also well marked and much indented; hind margin edged by a brown line, having flattened black dots between the crenulations; cilia white, intersected with pale brown.

Female extremely similar, but with quite simple antennæ, and the abdomen stouter, but sharply pointed, often showing a long ovipositor.

Underside creamy-white, or brownish-white, the fore wings rather clouded at the base and in the middle with smoky-black; no distinct markings, except the black marginal dots, but a faint indication of the second transverse line is visible on the hind wings. Body and legs pale yellowish-brown.

Exceedingly variable, and more especially so in local and climatal races. The most noticeable is a form which, with all the markings exactly as in the type, has the whole surface of the wings, with the thorax, so thickly dusted as to be fully tinged with ochreous-brown in varying degrees. This form was described as a distinct species, under the name of *T. laricaria*, by Mr. Stainton in his *Manual*. By others it has been treated of under the name of *T. crepuscularia*, but the correctness of application of this latter name is open to question. The subject of its distinctness as a species has been treated upon and debated in this country at enormous length, and not wholly without acrimony; but this healthy and somewhat drastic treatment has had the effect of crumbling away every atom of evidence which had been brought forward to establish its distinctness as a species, and of leaving no choice to an unprejudiced mind but the conclusion that these two races form but one species. The most remarkable circumstance in connection with this ochreous-



brown variety is that in the South of England, where it chiefly occurs, it emerges from pupa at large in March or April, and produces a partial second generation in July or August, which is smaller, paler, and very imperfectly furnished with the usual markings; while in the same localities, as well as elsewhere, the paler typical race emerges in May and the beginning of June, and has a very partial second generation in August. It is thoroughly established that the specimens on the wing in March and April are not the progenitors of those which appear very much more commonly in May and June; and thus this species has the singular habit of producing parallel races, constant in their emergence from year to year. Also, after much investigation, it is now made certain that in Midland localities and in Cheshire and Yorkshire, where the brown form is unknown, in those woods in which the parallel earlier and later races are found—as for instance in Delamere Forest and in some of the Yorkshire woods—the earlier as well as the later race was originally of the *creamy-white* type. Here, however, another strain of variation comes in—one in which the brown dusting almost or wholly disappears, and is replaced by grey or black. This in Derbyshire and other Midland districts is manifested in grey dusting in every degree from greyish-white to grey-black, the markings in all but the darkest specimens being still visible; and this occurs in both parallel races where these exist. Some of the specimens have curious and quite irregular and unsymmetrical blotches of whiter colouring, sometimes on the fore, at others on the hind wings. In specimens so much darkened that the markings begin to be absorbed, the white subterminal line resists the darkening tendency and begins to be noticeable. This is still more conspicuously the case in specimens from Glamorganshire, where a more deep and smoothly blackened variety early appeared—at first in the April race, more recently also in the other—the usual markings being quite absorbed, the surface smoky-black, and the nervures more deeply black,

but the subterminal line sharply white. With these are occasionally specimens of a deep black-brown colour. On the hills of South Staffordshire, on the other hand, I have found in June specimens having the ground-colour of the typical form, but so dappled and dusted with brown as to form an almost perfectly intermediate stage between it and the early brown variety. In Perthshire the brown variety of the South of England seems to re-appear, but of deeper colour, and having the markings deep brown or umbréous; and in Suffolk it has been found having the ground-colour umbreous, and the markings darker umbreous and black.

Between all the forms enumerated there exist all possible intermediates; and besides there are the second broods of both races, usually smaller, and most unsatisfactory in their poverty of colour and faintness of markings.

In the collection of Mr. Sydney Webb are specimens of an exquisitely pure creamy-white without brown dusting, but the markings quite distinct; also one which, having the fore wings normal, is shaded with purplish-brown upon the hind; and another, having the fore wings somewhat falcate, and a large round brown spot in the outer band, while the rest of its markings are obscure. In that of Mr. R. C. Bradley is a very white female in which the second line and its attendant stripe form a broad, strongly marked band, while the other markings, including the squared blotches, are quite indistinct—a striking and unusual aberration. One taken at Clevedon, Somerset, has the first line placed close to the base, and the second near the hind margin, and strongly marked, the middle portion of the wings forming a most remarkably broad white band. In Mr. S. J. Capper's collection two specimens, grey in colour, but not very dark, and showing the markings fairly well, have each of them a portion of one hind wing of the normal creamy-white colour, the division between the two colours being sharp, and running longitudinally down the wing, so as nearly to divide it in halves. Finally, the

neuration of this species is variable. Miss Kimber informs me that in both races the small nervures near the costa of the fore wings, veins 9, 10, 11, are very unstable in their form.

On the wing—first race in March and April, in very forward years even at the end of February—its second generation in July and August; second race in May and June, its second generation in August. I have taken specimens of the second race in Surrey as early as April; indeed, I find that both races occurred in one year in that month; also both races then produced second generations. This does not appear to be always the case in more northern districts.

LARVA twig-like; skin glossy; third segment enlarged laterally. twelfth segment furnished with a horseshoe-shaped prominence enclosing two minute tubercles; head small, slightly bifid, and rather triangular, greyish-brown, reticulated with dark brown; face flattened, and ornamented with an ochreous, indistinctly margined, transverse stripe; sides much puckered; general colour pale greyish-brown, shaded with red and grey; subdorsal lines conspicuous, interrupted, dark grey; dorsal line grey but indistinct, forming dark spots on the middle segments; third segment with two longitudinal black dorsal dashes and a black spot in the subdorsal line; spiracles black; legs and prolegs tinged with red; hump on the twelfth segment edged with black; tubercles ochreous; a dark grey waved shade on the sides below the spiracles extends from the head to the first pair of prolegs, forming a blotch on each of the middle segments, and continued underneath the tenth; undersurface between the prolegs greenish-white; three minute points on the anal segment. (C. Fenn.) Variable in colour to brown, reddish-brown on the back, and grey-brown, and even to dull black; also in the distinctness of the spiracular stripe, which sometimes is yellow and conspicuous, often but little paler than the ground colour. Mr. Fenn's description of the larva of *T. laricaria* does not differ in any material point from that quoted above; and a series

of excellent figures of both races, drawn by Mrs. Anderson for her father, the late Mr. W. H. Tugwell, indicates nothing more than the variation which naturally takes place in both. Mr. W. Buckler has figured a number of larvæ under each name, and he wrote me, twenty years ago, that the larvæ from which his *laricaria* were figured were somewhat shorter and stouter than the others, but added that he thought their distinctness very doubtful, and only deferred to the opinion of Mr. H. Doubleday.

May and June, and in a second generation in August and September; on oak, larch, elm, birch, blackthorn, plum, sallow and willow. Abroad it is somewhat destructive to fruit-trees and shrubs generally.

PUPA moderately stout, and very compact; front portion cylindrical; eye-covers rather prominent, glossy at the edges; limb-covers well marked, though smoothly laid, dull but not sculptured; antenna-covers barred with flattened channels; wing-covers dull and rather roughened with extremely minute and abundant cross-lines in irregular sculpture; segments evenly tapering, the front half of each sparingly pitted, hinder edge smooth; anal segment suddenly rounded, but having a stout conical cremaster, which tapers to a very short double point; colour red-brown. Among moss and dead leaves on the ground or beneath the surface, but without a cocoon. In this state through the winter.

The moth sits during the day, usually, upon the trunk of a tree, apparently preferring the smooth portions of the trunks of Scotch firs, which by no means serve to conceal it, except by its slight resemblance to a patch of lichen or to the splash of excrement of a young pigeon. It sits also upon trunks of larch, oak, birch, or, indeed, any convenient tree, or the stems of a bush, sometimes on posts and palings. At this time it is sluggish, clinging to the bark or wood, so that it may be pulled off by the fingers or with a pillbox, and can scarcely be induced to exert itself. At late dusk it flies, but

rather lazily, usually at a height of ten feet or more, and is not very often noticed on the wing for this reason. More especially attached to woods, but the paler specimens may not unfrequently be seen sitting on tree-trunks by the roadside in any fairly-wooded district. Not uncommon in suitable places throughout England and Wales, the creamy-white form being that most generally distributed; the ochreous-brown race seems to be confined mainly to Southern districts; the grey to the Midland and Northern Counties and the black to the latter and to South Wales. In Scotland the yellow-brown and dark brown forms are found in the large woods of Perthshire, and various greyer and white varieties, with the type, throughout the southern districts, Aberdeenshire, the Clyde Valley, Argyleshire and Sutherlandshire. In Ireland it seems to be fairly common in all well-wooded districts; and there Mr. de V. Kane tells me that the brown and creamy-white forms occur mixed together in May; those from the North of Ireland are often very prettily tinged in various degrees with grey, or black dusting.

Abroad it has a wide range throughout Central and temperate Northern Europe, the North of Italy, Corsica, Southern Russia, Bithynia, Tartary, the Corea, and Japan—whence a rather full-sized form has received the name of *excellens*—and where also small white and pale grey-brown varieties are common. Also in China, and India—in a suffused pale grey or yellow-brown variety with obscure markings. Found also in all parts of North America from Florida to Nova Scotia, but usually rather small and of a dusky pale brown colour, and named *occiduaris*.

While dealing at some length with the subject of variation in colour in this species, I have not touched upon the subject of the strictly modern character of the tendency to melanism which this species, like *Biston betularius* and some other species, exhibits. Fortunately there is sufficient evidence preserved to form a tolerable record of the change. In the

year 1866 Sir John T. Llewellyn recorded in the *Entomologist's Monthly Magazine* the capture in Glamorganshire of a "handsome leaden coloured variety of *Tephrosia laricaria*," from which he obtained eggs. From these eggs eight specimens were reared, five of which were similarly blackened; in subsequent years by pairing the black females with grey-brown males he obtained the black variety in larger numbers, and by pairing these, a still larger proportion, until all were dark. Ten years later he found that the same form of variation had extended to the later race, emerging in May, but that in this a greater tendency was shown to whiteness of the subterminal line. These forms appear now to be established in South Wales.

With regard to the similar change in England, the late Mr. Nicholas Cooke, of Liverpool, wrote, in the *Entomologist*, 1887: "The most interesting case of melanism that has come under my observation is the total change in the colour of *Tephrosia biundulata* in Delamere Forest. Some thirty years since, when I visited Petty Pool Wood, this species was very abundant, appearing in March, and was to be found through April and May, but all were of a creamy-white ground colour. Dark varieties were so scarce that they were considered a great prize. Now it is quite the reverse; all are dark smoky-brown, approaching black; a light variety is very rare." Confirmation of this is given by Mr. S. J. Capper, whose diary shows the capture of many specimens in the first half of the Aprils of 1869, 1870 and 1871, "all of the white form," by Mr. F. N. Pierce, and others. In October 1896 Mr. G. O. Day, of Knutsford, wrote me, "Blackened and dark grey forms are from Delamere Forest, March and May alike. Paler forms—white to pale brown and grey-brown—are found in North Lancashire." The conclusion seems, I think, to be tolerably safe, that although dark forms were not previously quite unknown, the great change of tint set in somewhere about the year 1860 and has continued to the present time; also that it has, so far as the blackened forms



are concerned, while strengthening itself locally, remained very restricted in locality; but so far as intermediate shades are in question greatly extended itself. It is worthy of remark also that the grey forms are well known in mountain districts on the Continent, though apparently not the black variety.

3. *T. extersaria*, *Hüb.*; *luridata*, *Staud. Cat.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{8}$  inch. Slender; fore wings greenish-grey, abundantly dusted and spotted with black; transverse lines, when visible, black, especially so on the costa; just before the hind margin is an irregular white stripe, joined in its middle to a large pale spot. Hind wings rather paler.

Antennæ of the male simple, rather thick, closely ciliated, black-brown, the shaft dotted with whitish-brown; tongue well developed; palpi extremely small, pale brown; face smooth, head rough, both blackish-brown, divided by a black transverse channel; eyes very prominent, leaden-black, striped with deep black; neck and collar golden-brown, the latter edged with black; thorax rough, golden-brown, dusted and barred with black; abdomen smooth, reddish-brown sprinkled with black; lateral tufts large; anal tuft small, yellow-brown. Fore wings moderately broad; costa arched; apex rounded; hind margin oblique and gently curved; dorsal margin a very little filled out, but thickly ciliated with long black and pale brown hair scales; colour soft light brown, abundantly dusted with black-brown; lines obscure, but rather direct, the first principally indicated by three cloudy black spots on nervures, that at the costa the largest; second line a series of small black dots hardly distinguishable among the black dusting; discal spot lunate, black; just behind it is a faint curved central shade, ending in a black dorsal spot; beyond the second line is a broken cloudy-black transverse stripe, the outer edge of which is formed into crescents and edged by a white subterminal line, while it is interrupted in the middle by a large squared whitish spot; a row of black

lunules edges the hind margin ; cilia pale brown, dashed with smoky-black. Hind wings broad, rounded and faintly crenulated behind ; brownish-white, dusted all over with dark brown, but more particularly so toward the hind margin, where also is an obscure series of rippled darker clouds edged outside, in some degree, with brownish-white ; cilia pale brown, tinged with pale red, and dashed with smoky-black. Female stouter but extremely similar, the white subterminal line and attached white blotch of the fore wings often broader and more distinct.

Underside of all the wings brownish-white, the margins tinged with pale brown ; costa of the fore wings speckled with black ; the discal spot a distinct black perpendicular streak ; the second line indicated in small brown dots, and a cloudy black stripe lying near the hind margin from the costa ; central spot of the hind wings very small, black, followed by a central transverse line of black dots. Body and legs very pale brown.

Scarcely at all variable, except in the intensity of the black dusting and markings ; but in the collection of Mr. Percy M. Bright is a specimen almost devoid of dark colouring, the general surface being as pale as the ordinary colour of the pale sub-marginal spot, which therefore becomes absorbed ; the transverse lines, however, are visible, but extremely slender.

On the wing in May, June, and sometimes the early part of July ; but in forward seasons and very favourable localities, such as the New Forest, sometimes to be found in April.

LARVA elongate, often with slight enlargements or transverse dorsal prominences on the fifth and ninth segments, especially on the latter ; head rounded, not highly polished, dull green, dusted with brown, face paler ; on the anal segment are two small points ; general colour dull hazle or chocolate-brown, often tinged with green ; the sides broadly blotched with blackish-brown or very dark ferruginous, which

colour is often continued upon the back, and there forms a broad, ill-defined bar on each segment; there is an indistinct series of pale quadrate dorsal spots, one at the termination of each segment, and a row of white or whitish subdorsal dots; the fifth and ninth segments are always transversely barred with black-brown or dark ferruginous; spiracles black, ringed with white; second, third, and anal segments tinged with green; under-surface hazle-brown, with a row of conspicuous whitish or yellowish spots of unequal size, but that portion between the second and fourth segments, and between the prolegs, bright green. (C. Fenn.) Inconstant in colour, varying from light green to dark brown.

July and August, sometimes in September, on oak, birch, willow, osier, hazle, and alder.

PUPA short and stout, the eye-covers prominent, head sloping obliquely off at the back; antenna-covers strongly barred with small channels, and limb-covers very much more minutely with incised sculpture; wing-covers dulled by extremely minute wavy sculpture of similar lines; all these portions olive-green, and the wing-covers rather transparent and tinged with yellow at their edges, which are swollen; dorsal and abdominal regions yellowish-brown, coarsely punctured all over, except upon the narrow, smooth hinder band of each segment; abdominal segments compact, but tapering off rapidly; cremaster broad, triangular, tipped with a minute curved spike. In a loose but thick cocoon of silk and earth or sand. In this condition through the winter.

The moth rests during the day on the trunks of trees, especially upon Scotch fir, but often on oak or birch, and is timid and restless, often flying off the moment that it is approached, and hurrying away, frequently escaping through thick undergrowth. Its natural time of flight is at dusk, but it flies rather high, and seems to prefer travelling over tall birch bushes. It is, however, strongly attracted by the sugar placed upon the trunks of trees to tempt *Noctua*, and

in favourite haunts may sometimes be obtained in numbers by this method, sitting on the sugared patch with its wings erect.

Restricted to woods, and local in this country, but found in suitable spots in Kent, Sussex, Surrey, Hants, Dorset, Devon, Cornwall, Somerset, Gloucestershire, Wilts, Berks, Oxfordshire, Hunts, Cambs, Herefordshire, Worcestershire, Essex, Suffolk, and Norfolk, but in some of these counties very scarce, or restricted to the largest woods. I know of no records further north, nor for any other portion of the United Kingdom. Abroad it is found through large portions of Central Europe, Northern Italy, Southern Russia, Tartary, and Japan.

4. **T. punctularia**, *Schiff.*—Expanse 1 to  $1\frac{1}{4}$  inch. Slender; fore wings ovate, greyish-white, dusted with grey, and having three or four obscure transverse lines, most noticeable upon the costa; hind wings of the same colour with two or three lines.

Antennae of the male simple, thickly ciliated with minute bristles, light brown; palpi very small, purple-brown; tongue well developed; eyes deep black; head hardly rough, grey-brown; thorax narrow, not very rough, pale grey, dotted with brown; abdomen smooth, whitish-brown, dotted with brown; lateral and anal tufts darker. Fore wings rather ovate; costa arched; apex rounded; hind margin fully rounded; dorsal margin rather full, strongly ciliated; colour whitish-grey dusted with dark grey; the first and second lines, and between them a central line, all slender, curved and rather rippled, lie parallel and at even distances apart, cloudy dark grey, thickened with black upon and near the costa and on two or three nervures; hind marginal region beyond the second line clouded with dark dull grey; in it is, upon the costa, the commencement of a fourth grey-black line or series of clouds, which edges a slender rippled white subterminal line; discal spot black; cilia grey,

dashed with white. Hind wings broad and rounded; the hind margin undulating and faintly protruded in the middle; whitish-grey, dusted with dark grey; near the base a partial black-grey transverse slender stripe commences upon the dorsal margin; in the middle is another, very slender but duplicated and longer; beyond this the sub-marginal region is broadly clouded with dark grey in which meanders an irregular angulated white line; cilia grey dashed with white. Female very similar, hardly stouter; but often with the ground colour whiter and the transverse lines more distinct.

Underside of the fore wings pale grey-brown, with an angulated cloudy black transverse stripe just before the middle, and a more curved one beyond. Hind wings dusky white, dusted with grey-brown; a complete curved dark grey transverse stripe lies near the base, and another, more slender and indented, just beyond the middle; central spot a black dot. Body and legs pale grey-brown.

Variable in the intensity of the dark grey dusting and clouding, a dark cloud being often visible outside the middle of the second line, and frequently, by the absence of some portion of the dark colour, two similar clouds near the hind margin. Still greater uncertainty exists with regard to the transverse lines, the first and central line being often obscure or obliterated except toward the costa, or the first remains and the central is partially absent; or all are clear, slender throughout, and distinct; or, on the other hand, each one is thickened on the costa into a black roughly triangular spot; more rarely the central line with its costal spot is obliterated, the spots of the other lines at the same time being exaggerated. In Dr. P. B. Mason's collection is an exceedingly pretty specimen, of a clear neat white, with all the lines sharply black, and the margins all spotted with grey-black. Specimens in Ireland are also sometimes of a particularly white tint. A specimen taken in the New Forest, and in Mr. Percy Bright's collection, has the outer half of the fore and hind wings much suffused with smoky-black; Derbyshire

produces dark grey specimens, and in South Yorkshire it has been found in rare instances very nearly black.

On the wing in May and June.

LARVA of moderately proportionate bulk; the head has the lobes rounded and is of about the same width as, or a little narrower than, the second segment; body of uniform width throughout, rounded above, but a little flattened beneath; segmental divisions well defined, and each segment rather numerously divided transversely into sections, which give the skin a somewhat rough appearance. Ground colour bright apple-green; head tinged with yellow; two yellowish-white lines, having a yellowish pulsating line between them, form the dorsal stripe; subdorsal lines yellowish-white; and there are two other lines of the same colour, but much finer and more indistinct, between them and the spiracular region; segmental divisions yellow; undersurface of the same colour as the upper, with pale middle and side lines and the segmental divisions yellow. (G. T. Porritt.)

Another variety, described by Mr. C. Fenn, is dull purple, clouded with darker, with a row of large indistinct whitish dorsal markings, most conspicuous at the incisions; head, legs, prolegs, and also the undersurface of the second, third, and fourth segments, and the space between the prolegs, dull green; head dusted with purple; remainder of the undersurface whitish, with a green tinge; second and anal segments also tinged with green.

Mr. W. Buckler has figured it in several shades of green and of purple-brown, also greenish-grey.

End of June and July on birch, and occasionally upon alder.

PUPA nearly half an inch long and moderately stout in proportion; of the ordinary shape, and tapering to the anal point, which is not very sharp; the wing, leg, eye, and antenna-covers well defined, those of the antennæ being conspicuously ribbed. There are also two short but distinct



points extending outwardly forward from the head; colour almost uniformly dark mahogany-brown. In a cocoon below the surface of the ground, formed by drawing particles of earth rather firmly together with silken threads. (G. T. Porritt.)

The moth sits during the day upon the trunks of birch trees especially, but occasionally on those of other trees or on fences, squeezing itself down as closely as possible to the surface, or if the wind is cold or rough, getting as closely as possible into the hollows and gashes of rough bark, and there clinging tightly, or falling to the ground if roughly removed. At dusk it flies, probably rather high, as it is seldom captured on the wing. Confined mainly to woods or heaths where birch is plentiful, but in such situations common throughout the greater part of England, and in the south abundant; in the north very local or scarce; probably also throughout Wales under the same conditions, but I only find it recorded in the north. In Scotland local, but extending to Argyleshire, Aberdeenshire, and Moray. In Ireland it is found in Wicklow and Kerry, but is not plentiful.

Abroad it is found throughout Central Europe, the temperate portions of Northern Europe, Central and Northern Italy, Eastern Siberia, Tartary, China, and Japan, where it is quite normal.

#### Genus 35. **BOARMIA.**

Antennæ of the male pectinated, but the tip simple; palpi small; head rather rough; thorax tolerably robust, covered with loosely raised scales; abdomen moderately slender, rather ridged with raised scales; fore wings broad and elongated, hind margin oblique and even; hind wings ample, hind margin only slightly scalloped.

LARVÆ large, elongate, twig-like, with small dorsal and lateral protuberances.

PUPÆ subterranean.

A grand genus, of which we have six species. They are rather difficult of tabulation.

A. Central spot of *hind* wings distinct.

B. This central spot a black lunule, wings ample, dusky white. *B. roboraria.*

B<sup>2</sup>. This central spot a black ring, wings narrower, brownish white. *B. consortaria.*

A<sup>2</sup>. Central spot of hind wings scarcely perceptible.

C. Second line of the fore wings thrice bluntly angulated. *B. repandata.*

C<sup>2</sup>. Second line of fore wings very oblique, joining the central shade, at the dorsal margin.

*B. rhomboidaria.*

C<sup>3</sup>. First line of fore wings duplicated into a broad curved stripe.

D. Fore wings broad, costa arched. *B. abictaria.*

D<sup>2</sup>. Fore wings rather narrow, costa nearly straight.

*B. cinctaria.*

The last-named has also usually a white bar across the base of the abdomen.

1. **B. roboraria**, *Schiff.* Expanse 2 to 2½ inches. Antennæ of the male strongly pectinated and stiff; thorax broad; fore wings ample, elongated, abundantly dusted with grey; transverse lines obscure, black, the second rippled and very oblique; subterminal line rippled, white, edged with black clouds; hind wings very similar, but with a lunate black central spot.

Antennæ of the male pectinated with long oblique ciliated teeth to three-fourths of their length, the apical portion being notched, pale grey, shaft pale drab; palpi very short and blunt, grey; tongue well developed; head rather rough, lower portion blackish-grey, upper part of face, with the head, greyish-white dusted with black-brown; thorax rather broad, whitish-grey or brownish-grey, barred across the middle and at the back of the collar with blackish-brown,

at the back is a short broad ridge or crest tipped above with white, below with black; abdomen slender, greyish-white dusted with brown and barred across the first three segments with black, upon the rest with grey; the first black bar has the scales partially raised and faintly crested; lateral and anal tufts whitish-brown. Fore wings elongated and very ample; costa faintly arched throughout; apex rounded; hind margin oblique and very gently curved; dorsal margin rather full and densely ciliated with whitish hair-scales which towards the base of the wing are raised; white powdered all over with grey dusting; first line broken, much curved, forming a black spot on the costa, another on the median nervure, and a long black streak on the dorsal margin which runs into the base; second line very oblique, curved and re-curved, black, disposed in crescents with a deep black point running out on each nervure; between these lines is a central shade, parallel with the first but nearly uniting near the dorsal margin with the second, and thence formed into an angulated black streak, otherwise most distinctly visible as a black spot on the costa; in it is the discal spot, rather ovate or elongated, black; near the hind margin is a white sub-terminal line disposed in crescents, within which, on the inner side, are small smoky-black clouds; beyond this line the hind-marginal region is more thickly dusted with dark grey; extreme margin dotted with black; cilia mixed smoky-grey and white. Hind wings of the same colour and similarly dusted; central spot lunate, small and black; before it is a much clouded transverse brown-grey shade; beyond it a slender black transverse line disposed in crescents with sharp points, and faintly edged outwardly by a band of brownish dusting; nearer the hind margin is a more cloudy black parallel line disposed in very flat obscure crescents, and edged outwardly with a white line; hind margin edged with short deep black streaks; cilia brownish-white. Female larger and stouter, with simple antennæ, and the transverse

lines on the wings often less definite or partially obliterated; otherwise quite similar.

Underside of all the wings creamy smooth brownish-white faintly dusted with brown along the costæ only; discal spot of the fore wings large, ovate, dull black, followed by a curved transverse line of black spots, largest and most distinct on and near the costa; before the apex is a perpendicular dull black-brown blotch consisting of three cloudy spots; central spot of the hind wings a small obscure faintly black streak, followed by a transverse row of faint similar spots which forms a central line, most distinct on the costal margin; cilia of all the wings yellowish-white. Body and legs brownish-white except the tarsi, which are black-brown barred with white.

Not very variable, but the dusting and markings, which in freshly emerged specimens are grey, fade very quickly during life, so that the majority of captured specimens are rather dusted with pale brown than grey. There is also some difference in this respect in different localities; and specimens in the collection of Mr. F. J. Hanbury, obtained in Essex, are strongly marked and very handsome. Mr. Sydney Webb has one much suffused with smoky-grey, and others with very conspicuously dark markings; and Mr. Percy Bright possesses a female example from the New Forest in which all the markings are obliterated, except those near the hind margins, which are unusually dark. Mrs. Bazett has taken, in the neighbourhood of Reading, Berks, a specimen which is almost black, and this leads to a form of extreme interest. It is, so far as I know, one of the most recent departures of any species, in the tendency to uniform blackness, which has been observed in so many of our Geometridæ within the last forty years. In 1893 I saw in the collection of Mr. S. J. Capper six specimens, all of a beautifully smooth smoky-black, devoid of the usual dusting and markings, but having the nervures of all the wings, and the central spot of the hind, deeper black. These came from a correspondent

in the Midland Counties, who was not willing to divulge the exact locality from which they were obtained. His statement was that he took the first, a worn specimen (which I have seen), about 1887, and that it was not till 1893 that he secured another—a female—from which he obtained eggs, and reared the fine examples above referred to. More were obtained, and Mr. Capper has had the pleasure of placing examples in various collections—mine among the number—but this strain has, I fear, died out. The Rev. R. Freeman, however, informs me that he has taken a single specimen in one of the Midland Woods; and future observation can alone decide whether the melanic influence increases in this species as it has done in others.

On the wing in June and July.

LARVA, viewed from above, of about uniform bulk throughout except at the sixth segment, but sideways it appears stoutest at the ninth and tenth; head narrower than the second segment, flattened in front, notched on the crown, the lobes rising in conical prominences; sixth segment very much swollen on the back and sides, and bearing a pair of puckered dorsal humps, the swelling begins just below the spiracle, which is thus lifted considerably above the level of the spiracles of the other segments; the seventh bears, on its undersurface, a pair of transverse puckered humps, in some specimens looking more like two sets of warts—three in each; the twelfth has a slight transverse dorsal ridge bearing a pair of warts; in some specimens the fourth also bears a pair of three-lobed, transverse, sub-dorsal humps; second and third pairs of legs well developed; anal flap triangular, somewhat rounded at the tip, the thirteenth segment, under the flap, ending in two blunt points, with a shorter, sharper one between them; skin glossy, but wrinkled on the hinder part of each segment. The ground colour is usually purplish-brown, sometimes more cinnamon-brown, the folds and humps dark brownish-grey; there is not much

pattern, and different individuals vary in the patches of paler colouring, some having broad patches of cream-colour in the spiracular region of the fifth and tenth segments; the sixth sometimes tinged with rust colour; the dorsal line appears as a paler dash on the front of each segment and a spot at the back; similar pale spots are sometimes seen where the sub-dorsal line should be, on the sixth and seventh segments; head brown; spiracles dirty white, outlined with black.

The newly-hatched larva is without humps, pale green with a broad dark brown lateral stripe, and the head pale reddish-brown. After the first moult a hump appears on the sixth segment, and the ground colour is pale ochreous. After this it gets darker in colour, the head becomes notched, and the other prominences appear.

The whole appearance of the well-grown larva, both in outline and colour, is extremely suggestive of an oak twig, and it preserves this resemblance under one or two changes of attitude, sometimes standing stiffly out, with the body in a straight line up to the eighth segment, then the seventh bent slightly upwards from this, and then from the sixth to the head again in one line, the head and thoracic segments more or less bunched together; sometimes standing off at a wider angle from a twig, and then with the whole front of the body from the sixth to the head inclined, in a stiff line, towards the twig again; in this position it looks like what had been a forked twig, with one of the forks broken off; in walking its humps lose much of their prominence and it then looks much like other stout Geometers. (Rev. J. Hellins.)

August till April or May on oak; hybernating when about one-third grown, upon the trees, slightly protected by silken threads attached to the twigs; and in spring, before the leaves unfold, gnawing the bark of the young shoots and the buds. At this time it has been induced, by Mr. Woodforde, to eat hawthorn buds; abroad it is said to feed also on apple.



PUPA very stout, thickest in the middle, though the wing-covers are not very prominent; head with the eye-covers slightly protruded, and the wing-covers abundantly sculptured or almost wrinkled with irregular transverse striæ; antenna-cases barred so as to show the joints, and in the male the pectinations; wing-covers abundantly and irregularly sculptured all over with minute waved lines; the dorsal surface and abdominal segments are sprinkled all over with minute pits, except the smooth glossy hinder band of each; anal segment wrinkled but very glossy; cremaster narrow, tapering to a long thick point; anal structure beneath it somewhat filled out; general surface dark chestnut-brown, smooth and rather glossy; anal segment darker, cremaster black. Under moss or among dead leaves, in the slightest possible cocoon, often the merest drawing together of a bit of leaf with a few threads, and not fully closed up.

The moth sits during the day on the trunks of oaks, often high up so as to be only reached with a pole, and prefers those trees which are surrounded by but little undergrowth. Here spread out flatly it would be very conspicuous indeed but for its close resemblance to a flat patch of grey lichen. At very late dusk it flies vigorously about the trees, usually at a good height, but will come late at night to the sugar laid on the trunks to attract *Noctuae*. Found only in woods, usually large woods with abundant oaks, and large open spaces; consequently very local in its distribution. Here its best known and most reliable locality is the New Forest, Hants, where it is found every year, and sometimes in very considerable numbers; and it is not very scarce in some restricted portions of Epping Forest, Essex. Other past or present localities exist in Kent, Sussex, Surrey, Berks, Wilts and Bucks, occasional specimens have been taken in Dorset, Devon and Middlesex, and there are two records in Suffolk. In the Midland and Western Counties it has been found in Warwickshire; at Cannock Chase, Staffordshire; Wyre

Forest, Worcestershire; and at Dunham Park, Cheshire; also in Yorkshire in a wood near Selby; and one specimen, which I have seen, in Cumberland. It even seems possible that it is spreading in this country, since several of the localities are but recently recorded, and I well remember my own surprise at taking a specimen in a wood in Surrey, which had, twenty years earlier, been one of my chief resorts, but in which I had, at that time, certainly never seen it. I find no record for Wales or Ireland; in Scotland the late Dr. F. Buchanan White stated that it had been taken at Dumfries, but no confirmation of this has been received. Abroad it is found throughout Central Europe, Central and Northern Italy, Livonia, Finland, Southern and Eastern Russia, Tartary, and Japan. In the last-named country it is found—like so many other species—of large size, also with a darker dusting of grey-brown; or else with the markings blackened and thickened; but also quite typical.

2. **B. consortaria**, *Fab.*—Expanse  $1\frac{3}{4}$  to 2 inches. Slender; fore wings ample and rather elongate, white dusted with grey-brown; transverse lines indicated mainly by slender black streaks on the nervures; hind wings similar, but the transverse lines more distinct and rippled; central spot a brown ring.

Antennæ of the male pectinated with rather short, oblique, ciliated teeth, to three-fourths of their length, the remainder notched, pale brown; palpi short and small, brown; tongue well developed; eyes leaden-black spotted with deeper black; lower part of the face smooth, dull purple-brown, upper portion, and the head, brownish-white, dotted with dark brown; thorax narrow, rather browner, the collar edged with umbreous and the shoulder-lappets faintly barred with the same; abdomen long, whitish-brown, each segment banded and dusted with dark brown; lateral tufts hardly perceptible; anal tuft narrow. Fore wings broad, and in some sort ovate; costa arched throughout; apex bluntly

rounded; hind margin oblique and gently curved; dorsal margin full, and strongly ciliated; colour brownish-white dusted and shaded with pale brown; base darker, forming a patch edged by the first line, which is brownish-black, very oblique, and sharply angulated just below the costa; second line oblique and tolerably direct, though formed of small crescents and short angles, dark brown; near it and almost parallel is an obscure brown central shade which becomes a deeper brown streak at the dorsal margin, and bends back to a brown spot in the middle of the costa; discal spot a hardly-perceptible oval brown loop centred with white; beyond the second line is a faint parallel band of brown dusting, and along the hind margin another; between them is a parallel series of dusky brown angles, faintly edged outside with white, this last representing a subterminal line; extreme hind margin dotted with black or brown; cilia brownish-white. Hind wings very broad, rounded and broadly crenulated behind; white dusted with dark brown; central spot a dark brown cloudy ring; before it is a partial brown transverse stripe arising upon the dorsal margin; beyond it a distinct dark brown transverse line, disposed in flat crescents, but edged outwardly by a broad band of dark brown dusting; beyond this is a cloudy brown stripe disposed throughout in sharp angles, and edged outside with white in a similarly angulated line; marginal region dusted with yellow-brown; cilia whitish-brown. Female rather stouter, with simple antennæ, and often paler colour, but very similar.

Underside of the fore wings whitish-brown, much dusted toward the costal region with brown; discal spot large, rounded, smoky-brown; hind wings very similar, rather whiter; central spot dark brown, followed by a slender imperfect brown stripe. Body and legs very pale brown.

Usually only a little variable in the depth of brown colour of the dusting and markings; but in the collection of Mr. S. J. Capper is a white specimen having the transverse lines

replaced by short disconnected cross dashes; and another suffused with ochreous and grey; in that of Mr. Percy Bright is a white female wholly irrorated with grey dots, the usual markings along the hind margins alone being visible. On the other hand, Mr. Sydney Webb has specimens suffused with dark grey, two, in Mr. Bond's collection, smoky-black, and a single example sooty-black; but it does not, as yet, appear that a black race of this species has been set up in these Islands.

On the wing from the end of May till July. Very rarely casual specimens have been taken in September, probably of a second generation, though it is not certain whether in this species emergence is not sometimes deferred.

LARVA twig-like, stout, with two large dorsal protuberances on the sixth segment, two points on the twelfth, and small lateral warts on the seventh, eighth, and ninth; flap of the anal segment bifid, and under it two projecting points; head dull brown, the face slightly paler, mouth shining, with a projecting point on each side; body ochreous, variegated with red, black and brown; protuberances on the sixth segment purple; points on the twelfth black; undersurface purplish-brown with three ill-defined dull orange-ochreous longitudinal stripes, the middle one broadest; spots dull black; spiracles whitish, edged with black.

Or—Head yellowish-brown, body uniform pale whitish-green, the protuberances on the sixth segment and the points on the twelfth yellowish-brown; spiracles white, distinctly edged with black; incisions of segments and hinder extremity tinged with yellow.

This last is the usual form in the young larva, occasional in the adult. (C. Fenn.)

Mr. G. T. Porritt describes further variations:

Ground colour pale glaucous-green, with a darker green dorsal line; humps on the sixth segment chocolate; those on the twelfth paler brown; anal segment and prolegs

yellowish-brown, with the bases of the latter dark chocolate; ventral stripes pink.

Or—yellowish-brown or greyish-brown, strongly marked or marbled with dark brown or red-brown; top of the head having a pale yellow streak, edged above with very dark brown or black, and the head generally dark; humps dark chocolate, the tips in some instances red; ventral surface partaking of the colour and marbling of the dorsal area, but the broad central stripe very conspicuous, ochreous-brown with a smoky edging, or sometimes interrupted with darker patches.

July and August, on oak, birch, and willow. Abroad it is found to feed also on apple, blackthorn, and raspberry.

PUPA short and stout; wing-covers prominent, glossy, irregularly thickened and hollowed, covered closely with abundant irregular striæ, incised and placed in every direction; eye and head-covers but little protruded; limb-covers flattened down but covered with wrinkling and incised striæ; antenna-cases rather conspicuous, broad, edged on each side with another ridge, and distinctly sculptured at the joints; dorsal and abdominal segments closely covered with abundant coarse pitting and minute swellings, except the hind band of each, where is a smooth hoop; cremaster triangular, running into a blunt spike, black-brown; general surface dark red-brown. In the earth, but hardly making any cocoon; or under the moss on oak trunks.

The moth sits by day upon the trunks of oak or fir-trees, closely pressed to a flat surface and much protected by its accurate resemblance to a patch of brownish-white lichen. It is, however, easily disturbed, and active in hot weather. It flies naturally at late dusk but keeps generally high up about the trees; and late at night will come freely to sugar, or to light. A very local species and confined to woods, usually large woods, in Kent, Sussex, Surrey, Hants and

Berks; rare in Dorset, Wilts, and Bucks, and once recorded, with doubt, in Suffolk. So far as I know this is the extent of its range in these Islands. Abroad it inhabits Central Europe, Northern Italy, Corsica, Livonia, the Balkan States, Southern and Eastern Russia, Bithynia, Tartary, Central and Western China, the Corea, and Japan.

3. **B. cinctaria**, *Schiff.* — Expanse  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inch. Antennæ pectinated, fore wings greyish-white; near the base is a curved double black-brown band, and beyond the middle another, more oblique and irregular; area beyond usually clouded with dark brown; hind wings somewhat similarly banded.

Antennæ of the male pectinated with rather widely placed, solid ciliated teeth, but the apical portion simple, dark brown; palpi short, horizontal, dull brown tipped with white; tongue well developed; face dark brown, upper portion of head rough, whitish-brown dusted with black; thorax slender, rough with raised scales, mixed grey, brown, and white; back of the collar black; at the hinder edge of the thorax is a small white tuft tipped with black, and immediately followed by a clear white bar across the basal segment of the abdomen, this also is edged at the back with deep black; and behind it the abdomen, which is slender, is light brown, with a black, or dark brown, edge to each segment; lateral and anal tufts tipped with white. Fore wings not broad; costa arched at the base and apex, almost straight between; apex rounded; hind margin oblique, very little curved but regularly crenulated; dorsal margin nearly straight, ciliated; colour white much obscured by dusting and clouding of reddish-brown and black; first line obscurely black, oblique, curved, blackened on the nervures and forming the outer edge of a broad stripe of reddish-brown or black-brown atoms, the other side of this band usually edged by a parallel black line; second line oblique, rather sinuous, black, slightly accentuated on every nervure, and edged outwardly by a band of brown



atoms barred with black; space between the first and second lines the palest portion of the wings, divided almost equally by a slender, oblique, and curved-back central shade; in it is the discal spot, which is oval, black-bordered and white-centred; space beyond the second stripe dusted and clouded broadly with black-brown, through which runs a very obscure, irregular, whitish subterminal line; cilia white, barred with smoky-black. Hind wings broad, rounded behind but with the anal angle squared, margin evenly crenulated; dusky white, dusted with brown; central spot elongated, edged with brown, centred with white; before it is a rather straight transverse black-brown stripe, and following it another blacker, more slender and rippled, edged outwardly with white, and this with light brown; hind marginal region clouded with purplish-brown, dusted with yellow, through which runs an irregular white line; touching this line a little above its middle is a black-brown spot; cilia grey, intersected with brown. Female usually more dusted with grey, but having the markings blacker and more distinct; antennæ simple; body stouter; otherwise similar.

Underside of all the wings dusky white dusted with brown, more so toward the costal half of each; devoid of markings except faint shadowings of those of the upper side. Body and legs pale brown; tarsi dark brown barred with white.

There is considerable variation in the depth of colour of the markings in this species, from dark brown to black; and even more in the degree of dusting and clouding of dark shades; from absence thereof the middle band of some specimens is brightly white, and the general tone of the moth is much brightened. This is often the case in specimens from the South of Ireland. In other cases the clouding and dusting are intensified until the dark markings are obscured and the creature presents a sombre aspect, the hind wings also being darkened. In the New Forest, Hants, specimens are occasionally taken having the two dark bands tolerably distinct or even well marked, but the ground colour entirely

white and devoid of dark dusting. Such are in several of the best collections. In that of Mr. S. J. Capper are two specimens, from the same rich locality, of a dusky-white colour devoid of the transverse stripes, except some blackish dashes on the nervures; also one unicolorous black male without markings, except that the nervures are of a deeper black. In Mr. R. Adkin's collection is a specimen from the South of Ireland, abundantly suffused with dark dusting, but having the borders of the wings broadly black; and a number of specimens of both sexes, reared by Mr. B. A. Bower, have the double first line and the whole hinder space from the second line rich velvety black, clouded off at the edges of the markings, and the ground colour in the middle of the wings white. One also in the Rev. J. Greene's collection is black from the base to the first line, and from the second line outwards, but with the central band brightly white.

On the wing from the end of April till June.

LARVA one and a half inch long, moderately slender, nearly of uniform thickness when viewed from above, but when viewed sideways seen to taper a little from the tenth segment in each direction; head rather wider at the mouth than at the back; skin soft and smooth; general colour a light and delicate green, the head the lightest portion, and rather pink at the mouth; ocelli black; dorsal region much lighter than the sides and undersurface, from the number and closeness of pale longitudinal lines, which are only relieved by fine thread-like edges of the green ground; dorsal line rather bluish-green, darkest near each segmental division, and having an exceedingly fine, ragged, greenish-white central thread; close on either side of it is a ragged-edged yellowish-white or pale yellow line, followed closely by another, less light or fainter, and again by another ragged-edged whitish subdorsal line; these are each defined by a fine thread of green edging, and are relieved below by a wide line of rather darker bluish-green, having a very fine ragged paler thread running through it;

below again is a faint greenish-white thread edged with a darker thread of bluish-green, followed by a broad stripe of the ground colour, only faintly marked with the slightest possible trace of a pair of paler threads along the spiracles, which are small, roundish-oval and flesh-coloured, delicately outlined with black; the skin below them a little puckered and showing a yellowish tint in some places; undersurface more bluish-green, faintly edged with a darker green than the ground colour; on either side are two faintly paler ragged lines, also edged with darker green; the lines of the back all terminate in front of the anal flap, which is light yellowish-green with a sprinkling of most minute black freckles, and the lines are all faint upon the second segment; freckles also occur on the hinder parts of the anal legs; a fine short black bristle, only visible under a strong lens, proceeds from each of the usual raised dots. The infant larva is dark olive-brown with pale olive-green head, and whitish dorsal and spiracular stripes; after the first moult pale greenish-yellow with a very broad darker green stripe on each side; after the next, olive-green, with several fine equidistant double longitudinal darker lines; then paler, with the lines hardly visible; but when half grown having darker lines and an addition of white subdorsal stripes; when still larger the lines more distinct and the subdorsal white stripe relieved by one of a darker green beneath; and it is not until after the last moult that the adult colouring is assumed. (Adapted from the long description by Mr. W. Buckler.)

From the end of May till July, and sometimes the beginning of August; on birch, willow, cross-leaved heath (*Erica cinerea*), and knot-grass; but Hofmann says on blackthorn and many low-growing plants—*Cytisus*, *Genista*, *Calluna*, *Hypericum*, *Biscutella*, and *Artemisia*. It certainly has no such extensive range of food plants in this country!

PUPA of ordinary shape, thickest at the ends of the wing-cases; plump, tapering rather suddenly to the anal tip, which

has a small projection, and a spike from it divided into two sharp points; abdominal divisions smooth; the rest of the surface finely punctate; rather shining; colour dark mahogany-brown; on the abdomen are a few extremely fine short hairs pointing backwards. Without any appreciable cocoon, at a depth of four inches, loose in coarse friable soil. (W. Buckler.)

The moth sits during the day upon the trunks of birch and holly trees, but more frequently on heather stems. If disturbed will often drop down and simulate death—which among heather is perhaps the most effective and aggravating method of concealment; its flight is doubtless at night, but seems to be rarely observed. An exceedingly local species, found on large heaths and in our more extensive forests. Its chief locality in this country is the New Forest, Hants, and here it is usually common, and sometimes very abundant; also found in other forests and wide heaths in the same county, and Dorset; at Tilgate Forest and near Brighton and Battle, Sussex; and in Berks. A record in Devon seems to be somewhat dubious; and Mr. Buxton's ancient statement of a Scotch locality "amongst alders at Dalmally," which has never been confirmed, is surely erroneous. So far as can be ascertained, it is confined, in Great Britain, to the four counties first mentioned. In Ireland it is more widely distributed, and in the south is of rather large size and striking markings, being abundant in some parts of Kerry; taken at Markree, Sligo; Kells, Meath; and even once on a mountain at Glenveagh, Donegal. Abroad found throughout Central Europe, the temperate regions of Northern Europe, Central and Northern Italy, the Balkan States, Tartary, and Japan.

4. **B. abietaria**, *Schiff.*—Expanse  $1\frac{3}{4}$  to 2 inches. Forewings broad, satiny, dusky white, or pale olive-brown, dusted and clouded with soft rich umbreous; transverse lines black, irregular or fragmentary, but forming large black costal spots; hind wings more smoky-brown.

Antennæ of the male pectinated with regular, even, solid, ciliated teeth to near the apex, a short portion only being threadlike or notched, dark brown; palpi horizontal, rather projecting, reddish-brown; eyes minutely reticulated all over, deep black; face smooth, head more rough, both umbreous; thorax thick but rather narrow, rough with long scales, umbreous; abdomen smooth, not very slender, reddish-brown, faintly barred with black-brown; lateral and anal tufts well developed. Fore wings broad, very satiny in texture; costa arched at the base and toward the tip, straighter between; apex bluntly angulated; hind margin very faintly crenulated, curved, not very oblique; dorsal margin rounded, ciliated; colour whitish-brown or pale olive, clouded and speckled nearly all over with velvety or satiny umbreous stippling, which under a lens is seen to be arranged in perpendicular lines of various lengths; first line rather erect, curved, of irregular thickness, black, thickened at the costa, edged inwardly by an ill-defined band of the umbreous clouding; second line much more oblique, formed of short thick black curves, with elongated, thickened black points at their junctions; bent back and then forward near the costa, and there thickened into a deep black blotch, broadly bordered on the outer side by an umbreous band; between these lines an umbreous central shade arises from a black spot or blotch in the middle of the costa, joins the ovate black discal spot, and proceeds as a fainter oblique tapering stripe to the dorsal margin; halfway between the stripe of the second line and the hind margin is another umbreous transverse stripe, or succession of clouds, containing velvety black spots, and edged outwardly by the subterminal line, which is irregular, interrupted, white or yellowish-white; the hind-marginal region is clouded with velvety umbreous, and at the edge spotted with deep black dots or lunules, which usually throw back streaks on some of the nervures; cilia pale brown clouded with umbreous. Hind wings broad, rounded, decidedly crenulated behind; pale brown, clouded with umbreous, but



in a less degree than the fore wings; in the middle is a slender transverse line of brown crescents, their tips dotted with black; sometimes before it a fainter partial line principally visible at the dorsal margin; hinder region rather more dusted or clouded with umbreous, and in it an indistinct line or row of yellowish-white streaks and dots, or clouds; hind margin spotted with deep black lunules; cilia pale brown, clouded with darker. Female rather larger, much stouter, with simple antennæ, sometimes lighter in colour and with more emphasised markings.

Underside of all the wings pale yellow-brown; fore wings shining, the discal spot and the transverse lines and more conspicuous shades of the upper side indicated in dull brown; hind wings having two dull brown transverse stripes, one before and the other beyond the middle; cilia pale brown, spotted with pale yellow. Body and legs brown, tarsi blacker, barred with pale brown. †

Rather variable in the depth of colour of the clouding and stippling of brown on the wings. Mr. S. J. Capper has a specimen, taken in the New Forest, in which all the clouds and brown shades are smoky black, and the markings more deeply black; and another in which the whole, except the transverse lines, is of a rich bright brown. A female specimen from Woolmer Forest, Hants, is suffused with smoky-brown, the transverse lines being hardly perceptible; and Mr. G. T. Porritt possesses specimens from East Kent, in which the mottled clouding is of a greenish-black. But the most striking and interesting variation in this species is a form which seems to be quite confined to the South of England; its fore wings are of a rich velvety black, not very shining, without the usual markings, but having the discal streak and the nervures all deeper black; hind wings smoky-black; antennæ, thorax, and even abdomen blackened. There is no record of the earliest appearance of this form, but I well remember that forty years ago it was reared by the late Mr. W. Machin from larvæ obtained from Leith Hill,



Surrey. More recently the late Mr. W. H. Tugwell found it to be the dominant form among the yew trees of Mickleham Downs and Boxhill, in the same county; and it has been obtained, along with the more typical specimens, in the New Forest, Hants.

On the wing in June, July, and the beginning of August. A casual specimen obtained in 1868 as late as August 29th may have been a late specimen only, since we have no other evidence of a second generation in the season.

LARVA one inch and a half long; head a little less than the second segment, its lobes rounded and well defined on the crown; the segmental divisions indicated by a fold of the skin; beyond the thoracic segments the dorsal region of each has two anterior faint wrinkles and three or four towards the hinder end, rather deeper on the sides; here the skin is much puffed and puckered, especially along the spiracular region; muscles of the ventral and anal prolegs largely developed; raised dots rather prominent, especially the hinder dorsal pairs, which are larger than the front pairs, and, as well as those along the sides are on little tumid eminences; head much freckled with reddish-brown; a brown conspicuous spot on the front of each lobe, and another just above each papilla; of the ground colour there are two varieties; one is light ochreous-brown, having conspicuously paler cream-coloured patches on the back of several segments; the other dark greyish-brown with paler patches, sometimes of a light cinnamon-brown, often palest on the fifth, ninth, and tenth segments; the dorsal line is but just indicated on the thoracic segments by very short, double, black marks at their divisions, but it is more complex on the other segments, being composed of a fine central pale thread within two lines, or series of brown freckles, which widen and contract on each segment; parallel to these is a pale line edged outside with a line of brown freckles, lighter and darker; and then with an interval of ground colour a stout pale subdorsal line, edged on each

side by a thin line of brown freckles; the front pairs of raised dots are black on the fifth to ninth segments, and the hinder pairs, though pale in part, are involved in a strong black mark which, flowing from them, darkens parts of both adjacent lines to the segmental division; spiracles strongly outlined with black; in front of each of them is a short line of a few black freckles; lines occur on the undersurface, but are very faint; each raised dot emits a fine short bristly hair, and these hairs are rather numerous on the head and the anal segments and prolegs.

On first emerging from the egg very slender, head ochreous-green, dorsal stripe very pale green, subdorsal stripes blackish-olive, spiracular stripes whitish-green, and undersurface dark olive-green; in a few days the colour of the stripes is browner, and in the middle of the dorsal stripe appears a fine dark green line; at a fortnight old the stripes begin to divide into fine lines; when half grown it is light brown, having dark lines with paler edges, and the adult markings begin to appear. (Condensed from Mr. Buckler's description.)

August till June, hybernating when about half grown. On yew (*Taxus baccata*), spruce, Scotch fir, silver fir, birch, whortleberry, oak, and beech. Yew appears to be its favourite food, but where this is absent, and the larva is found on some species of fir, it shows a singular willingness, in confinement, to forsake that food for birch—yet I know of no instance of its having been found upon birch at large!

PUPA about three quarters of an inch in length, stoutest across the ends of the wing covers, whence it tapers gradually to the end of the abdomen; this is furnished with a tapering projection separating near the end into two short fine points; surface of the thorax and wing-covers smooth; abdominal rings very finely punctate, their divisions smooth, and of a dull violet-brown colour; all the other surface dark brown and glossy; apparently it makes no appreciable cocoon, and a few days before the moth is disclosed the pupa makes its

way upwards towards the surface of the earth. (W. Buckler.) The Rev. J. Greene says that it may be found, in some places not rarely, at roots of fir.

The moth sits during the day on branches of oak trees and of the various species of fir, or yew ; apparently even hiding among the needles ; it may be dislodged by a heavy blow of a beating stick, but is not very easy to capture, from its clever trick of flitting away into the most shady place available, when its dark colour acts as a means of concealment. Its natural flight is at night, is doubtless around large trees, and is hardly ever observed ; but it has been taken by means of a strong light. Usually found in large dark fir-woods, or on chalk downs among yew, but always exceedingly local. In such suitable spots it is frequent at Leith Hill, Box Hill, and Mickleham, Surrey ; in the New Forest and Woolmer Forest, Hants ; at Tilgate Forest, Sussex ; at Black Park and Halton, in Bucks ; and is found more rarely in Dorset, Devon, Cornwall, Somerset, Berks, Gloucestershire, and Monmouthshire. This I believe to be the extent of its range in these islands. Abroad it is found in Eastern France, Belgium, Germany, Switzerland, Galicia, and Siberia ; also, in all probability, having some extent of range in Asia, since a large and strongly marked form exists in Japan.

5. **B. repandata**, *L.*—Expanse  $1\frac{1}{2}$  to 2 inches. Fore wings various shades of umbreous, pale brown, red-brown, brownish-white, or greyish-white ; dusted, mottled, marbled, or banded with dark brown ; the second line, which is thick, black, and rather even, forms a large stiff angle or elbow above, and another below, the middle ; subterminal line angulated throughout, white or pale brown ; hind wings similar in colour.

Antennæ of the male pectinated with short solid ciliated teeth, but the apical portion simple, brown, shaft paler, shining ; palpi short, dark brown ; tongue long and well developed ; face smooth, dark brown, head paler brown and

rather rough; thorax slender, roughened with loose scales, light or dark brown; abdomen similar, slender, a narrow darker brown bar across each segment; lateral tufts minute, anal tuft narrow. Fore wings moderately ample, elongated; costa gently arched; apex bluntly angulated; hind margin crenulated, oblique, and gently curved; dorsal margin nearly straight, ciliated; ground colour pale brown, smoky-brown, or whitish-brown; first line thick, black, curved, and partly duplicated; followed by an oblique cloudy-brown central shade, which forms a large brown costal blotch, and encloses a small black discal streak; second line thick, black, stiff-looking, and without indentations, disposed in two or three large step-like angles; immediately outside it is usually a parallel light brown line; outside this is a very irregular series of black or black-brown clouds, or the whole outer surface is clouded with brown; through it runs an excessively rippled and angulated white or pale brown subterminal line; extreme hind margin edged and dotted with black; cilia pale brown. Hind wings broad, rounded, strongly crenulated, similar in colour to the fore wings; central spot small, brown; before it is a partial cloudy brown transverse line; beyond it a more definite, curved, and somewhat undulating black-brown line, edged outside with white, and followed by a fainter parallel reddish-brown shade; beyond this is a much angulated and indented black-brown cloudy stripe, which also is faintly edged with white, and followed by a cloudy stripe of fulvous dusting; extreme hind margin edged with black lunules; cilia pale brown. Female stouter; with simple antennæ; wings often more clouded with white, or with grey dusting, but the markings usually more definite; otherwise similar.

Undersides of all the wings light brown, with smoky indications of the transverse lines, and of the markings generally, all spread and blurred; basal portion and middle of the fore wings more clouded with smoke colour. Body and legs light brown. In the male a long tuft of hair-scales on the third pair of legs lies usually closely pressed to the leg.

It is scarcely within the compass of human patience to do full justice to all the variations of this fine but most unstable insect—certainly the endurance of the reader would never stand such a strain, if the writer should attempt it! Hardly any two specimens are quite alike, but the description above is of perhaps the most reliably typical form. The ground colour varies from the shades of brown already mentioned to umbreous, reddish-brown, white, or grey-white; the dusting or clouding to any shade of grey, grey-brown, dark brown, or to black; and the lines are very often partially obliterated. Perhaps the handsomest variety is one found principally, if not solely, in the South of England and Wales, and known as var. *conversaria*; in it the space between the first and second lines is quite filled in with dark smoky-brown or smoky-black, so as to become a grand central dark band with definite exterior angles, sharply defined against the pale or whitish ground colour; a similar, but more partial, dark cloud or band appears also upon the hind wings. In this variety the ground colour of the wings varies from white to brown, and the dark band is in some individuals narrow, in others very broad, from the variable positions of the first and second lines; and in Devon, where this strain of variation is particularly frequent, some of the lovely specimens have the ground colour creamy yellowish-white, and the band black. Quite a different series of colour-varieties is found in plenty in the Scottish Isles, more particularly in the Hebrides, where they seem to have quite replaced the typical forms; in these the expanse of wings is smaller, and the ground colour is white or greyish-white, without usually more than the smallest tinge of brown, but very much dusted and dappled with grey or grey-black; the first and second lines very slender and obscure, or else absent; the subterminal line usually distinct, often very white and charmingly edged with grey clouds; in Shetland a rather similar form shows the transverse lines more distinctly. Trees being scarce or absent in these islands, the grey forms are found usually



among heather or *Vaccinium*, or sometimes upon rocks. The first mention of this strain of variation seems to be by Curtis, who described it as a distinct species, under the name of *muralis*, and said that it was found on walls in the Isle of Arran. The most recent, and in some respects the most striking, departure in this species made its appearance, so far as is recorded, about the year 1887 in South Yorkshire, where it was found by Mr. G. T. Porritt. In it the ground colour is, as in other species in that district, black, sometimes deep black, more frequently smoky-black; in the extreme forms the surface is almost smoothly black, with the nervures of a deeper shade; in others the markings are faintly visible; again in others a rippled white subterminal line is obscurely visible, or else bright and conspicuous on both fore and hind wings; and again, others possess white clouds and streaks along the area of the second line. With these are found intermediates of every shade of smoky-brown and brown-black, with or without the ordinary markings; but, so far as I have seen, melanism has not as yet progressed so far in this species as to obliterate all the usual markings in more than a very small proportion of the specimens; neither does it seem to have extended itself over the country. In the South-West of Ireland a dull brown form is found in which the markings are very strongly black, but the general range in that country is as here—ordinary forms throughout the Southern districts and well into the north, where gradually the grey form of the Scottish Isles appears, but in the full ordinary size. A curious variety, taken near Dublin by Professor Hart, is unicolorous dark smoky-brown, and bears a queer resemblance to the dark form of the next species. In an interesting specimen in the collection of the Rev. Joseph Greene the very strongly rippled pale line of the hind wings and the deep markings of the fore wings seen in the black Yorkshire varieties are repeated in umbreous and light brown, and the rippled line is nearly white.

On the wing in June and July, sometimes even at the end



of May. In the year 1893 Mr. Robt. Adkin reared a partial second generation in September, from eggs laid at the end of May; such a circumstance does not seem to have been observed at large.

LARVA elongate, not humped, sides much puckered; head rather quadrate, brownish-ochreous, dusted with black; face flattened, paler; general colour brownish-ochreous tinged with darker upon the back; dorsal line greyish-ochreous, slightly enlarged in the middle of each segment; subdorsal lines exceedingly threadlike, composed of minute white dots; spiracles black or dark brown; usual raised dots black; on the undersurface are numerous longitudinal pale brown markings and a broad central whitish stripe, edged on each side with grey, and enclosing a brown line; underside of legs and prolegs dull green.

Or—Ochreous, with outlines of dark purplish-brown dorsal diamonds, especially from the fifth to the ninth segments; dorsal line dark purplish-brown, darker on some segments, and enlarged into a blotch particularly on the sixth, seventh, and eighth; sides shaded with brown; a conspicuous row of blackish spots lies above the faint brown subdorsal line; usual dots and spiracles black; on the undersurface is a broad pale ochreous stripe margined with dark grey.

Or—Chocolate-brown, marbled with white and orange-brown on the back; dorsal line dark greyish-purple, enclosing a whitish thread, and bisecting a series of, often indistinct, paler diamonds outlined with dull black; undersurface dull reddish; central stripe dusky-white, enclosing a reddish line.

Or—Entirely chocolate-brown, marbled with dark brown, except the undersurface which is as above. All these varieties graduate into one another. (C. Fenn.)

July to May on blackthorn, hawthorn, apple, cherry, aspen, birch, oak, hornbeam, ash, elm, hazel, bramble, honeysuckle, heather, *Clematis vitalba*, *Ruscus aculeatus*, *Vaccinium myrtillus*,

*Genista tinctoria* ; fonder of undergrowth than of trees ; feeding principally at night, but remaining during the day upon the twigs of its food plant.

PUPA not very stout, decidedly glossy, eye-covers and mouth-organs well marked, limb-covers very compact and not conspicuous ; antenna-covers strongly cross-barred with incised sculpture ; wing-covers abundantly furnished with shallow and most minute incised lines ; back of the thorax more distinctly so ; dorsal and abdominal segments coarsely and abundantly pitted, except the hinder bands, which are smooth and broad ; abdomen rather swollen and very little tapering, but suddenly rounded off at the anal segment ; cremaster standing out very distinctly, roughly granulated, conical, finished off by a sharply pointed, and forked, stout spike ; general colour red-brown ; cremaster dark brown. In the earth, but scarcely provided with any cocoon.

The moth sits by day on the trunks or branches of trees, especially fir-trees, and in thick bushes and hedges ; it is restless and easily disturbed, flying hurriedly away to some similar hiding-place. In the northern moor and island districts, where trees are scarce, it sits among heather or on rocks or even walls. It flies naturally at dusk, and comes freely to sugar placed on trees for the attraction of *Noctuæ*, resting upon it with the wings perpendicular and quite ready for flight. Plentiful throughout the United Kingdom, and in wooded districts usually abundant. Abroad it has an extensive range, Central Europe, the temperate portions of Northern Europe, Central and Northern Italy, Turkey, Southern Russia, Bithynia, Armenia, Eastern Siberia, Tartary, North West India, Afghanistan, Central, Western, and North East China, and Japan—from the last-named very fine forms are received, and known as *B. angulifera*.

6. **B. rhomboidaria**, *Schiff.* ; **gemmaria**, *Staud Cat.*  
—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Fore wings rather silky, dull

pale brown, softly clouded with smoke-colour ; two transverse lines gradually converge and unite upon the dorsal margin ; hind wings very similar in colour.

Antennæ of the male pectinated with rather long slender ciliated teeth, tapering off in the upper portion, and leaving the tip threadlike, smoky-brown, the shaft light brown ; tongue long ; palpi short and blunt, dull brown ; face smooth, black-brown ; head tufted, paler ; thorax rather pale brown, slender, somewhat shining and very little roughened ; abdomen long and slender, whitish-brown, distinctly barred at the edge of each segment with more smoky brown ; lateral tufts spreading ; anal tuft small. Fore wings moderately broad ; costa very gently arched ; apex rounded ; hind margin very gently curved and minutely crenulated ; dorsal margin a little filled out and strongly ciliated ; colour dull pale brown, dusted or clouded with smoky-brown ; first line obscure, slender, oblique, black-brown, forming a distinct spot on the costa ; second line distinct, very oblique, black, arising from a black spot on the costa, bending out and then back in a long sweep to the middle of the dorsal margin where it forms a distinct black crescent ; between these another black costal spot gives rise to a more direct, cloudy-black transverse stripe, or central shade, which crosses the black discal spot, joins the second line just above the dorsal margin, then separates and forms a black streak or crescent by the side of that just mentioned. The regular approach and conjunction of these two lines, and their twin black dorsal erect streaks are very characteristic of this species. The second line is edged outwardly by a faint series of minute white clouds, outside which the broad space to the hind margin is much clouded with smoke-colour ; a cloudy black divided spot on the costa is placed before the apex ; another below it throws black streaks into the hind margin ; others still below and much fainter, more or less margin an indistinct white subterminal line, which is very irregular ; extreme hind margin edged with black streaks ; cilia light brown,

spotted and shaded with smoky-black. Hind wings broad, rounded behind, and faintly crenulated; whitish-brown, dusted—especially on the dorsal and hinder portions—with dark umbreous; central spot small, smoky-black, before it is a partial transverse umbreous line; close beyond it another, complete and arranged roughly in crescents; nearer the hind margin is a broad ill-defined cloudy stripe, most distinct in its dorsal portion, edged outside by a parallel irregular white line; hind margin edged with black crescents; cilia whitish-brown, clouded and dashed with darker. Female stouter; with simple antennæ; wings paler, with the dusting more brown, and the markings more distinctly expressed.

Underside of the fore wings pale smoky-brown, shading to whiter in the dorsal half; discal spot black; the lines and clouds of the upper-side, beyond it, all obscurely visible and cloudy. Hind wings whiter, with the central spot and following lines all similarly indicated. Body and legs pale brown; tarsi smoky-black, barred with brownish-white.

Variation in this species is mainly along a definite line—more than thirty years ago a form, then supposed to be found only in the Loudon district, was brought into notice under the name of *B. perfumaria*. In it the whole surface of the wings, with the thorax, is smoothly suffused with smoke-colour in a greater or less degree, the markings remaining normal; but with it also occurs rather rarely, and more particularly in the female, a form in which the shading leans very curiously towards smoky-white; in both these the ordinary brown colouring is almost entirely obscured or obliterated. The smoky form is now known to occur at Birmingham and in other large cities, and also to be almost the only one found in the southern parts of Yorkshire and the adjoining districts. More recently a further advance has been made in dark variation, and coal-black specimens of both sexes have been obtained—not in the usual Yorkshire localities—but at Norwich, from which city very strikingly black specimens have been sent by the Messrs. B. and E. Tillett and

Mr. H. T. Thouless ; in these the transverse markings, though not wholly obliterated, are partially so, and the nervures are more deeply blackened. Specimens somewhat similar but hardly so dark have recently been found in the South of Scotland by Mr. W. Grant Guthrie ; and others on Cannock Chase by Dr. Freer.

On the wing in July and August, sometimes even at the end of June. Occasionally specimens of a partial second generation, and of smaller size, are found in September, and Mr. F. J. Hanbury has observed this second brood commonly in the Isle of Wight.

LARVA elongate, twig-like, wrinkled at the sides ; head slightly bifid, flattened in front ; sixth segment with two very slight lateral protuberances below the spiracles ; anal prolegs spreading. Very variable in colour and markings :—dull purple, clouded with ochreous, and with more or less distinct indications of ochreous dorsal lozenges ; or ochreous with grey dorsal lozenges ; or unicolorous dark dull purple ; on the undersurface is a very conspicuous pale ochreous or whitish longitudinal band, margined with black, and enclosing a dark grey line. (C. Fenn.)

Mr. Edward Newman describes it thus—the colour of the head is dark umber-brown ; the face approaching to black, the crown paler, the palest part of all being the ridge where the crown and facial disk unite ; body rich umber-brown, exhibiting traces of three slender white dorsal stripes, of which the middle one is straight, and bordered, especially on the second and third segments, with black ; the anterior margin of the second segment is also black ; the lateral white stripes are waved and all three are interrupted at intervals, and broken up into dots ; there is a pale and tolerably broad medio-ventral stripe, delicately bordered on both sides with pure white ; on each side of this is a similar stripe rather indicated than expressed ; between the ventral and anal prolegs the ventral surface is pale.

Mr. Buckler's figures indicate further varieties—purple, brown, and grey, with or without dorsal or subdorsal pale lines.

July or August till May or June, hybernating early and while still small, on a silken carpet, upon the lower twigs of its food plant; recommencing to feed in April. On privet, ivy, elder, lilac, hawthorn, blackthorn, birch, elm, rose, honeysuckle, clematis, jasmine, laurel, snowberry, vine, broom and even fir—from which last unsuitable food the specimens reared are very small—feeding at night, remaining upon the food plant by day. Although frequenting so many various trees and shrubs it does not appear willing to change from one to another, but has been known to die of starvation in preference. It was supposed at one time that the dark variety known as *perfumaria* was produced only from larvæ fed upon ivy, but this has been abundantly disproved, dark forms having resulted from those fed upon lilac, elder, blackthorn, and birch. The varieties in the larva itself are, however, often found to assimilate in colour most accurately with the twigs of the plant upon which it is feeding, but Mr. Fenn says that it is often betrayed to the eye of the keen observer, by its habit of turning its undersurface outward, when the pale band is readily seen.

PUPA rather slender; eye-cases prominent; anal extremity spiked; mahogany colour, the wing and antenna-cases mottled with blackish. Subterranean, not inclosed in a cocoon. (C. Fenn.)

The moth shows a special preference for gardens, more particularly for those situated in and around London and other cities and large towns. Here it sits in the daytime upon any railing, post, outhouse, or other wooden structure; on walls, or among ivy and dense bushes; and is watchful and easily disturbed, flying wildly away when approached, to settle in some other secluded spot. At dusk it flies about the gardens, and when darkness comes on is strongly attracted



by any bright light, so that on a hot summer night, when the top portions of windows are thrown open, the males come in, sometimes in numbers, rush into the lighted gas-flame and precipitate themselves, singed, upon the supper table, to the no small discomfort of the ladies. Both sexes are in some degree attracted, but only the males in any numbers. Less common in the country, yet to be found in tolerable plenty throughout England and Wales, in the cultivated districts, though most abundantly in the South and the metropolis. In Scotland it seems to have been confined to the South and East, but in 1890 Dr. Buchanan White reported that its range was extending, and that it was becoming common at Perth. In Ireland it is local, of course preferring the suburbs of towns, and has been taken freely in Dublin, Wicklow, Waterford, Cork, Kerry, Galway, Sligo and Fermanagh. Abroad it is found all over Europe, with little variation in colour, also in Asia Minor, Syria, Armenia, Tartary, the mountainous regions of Central Asia, and Japan.

#### Genus 36. **HEMEROPHILA.**

Antennæ of the male partially pectinated, the tip simple; palpi small; head rough; thorax narrow, roughened with raised scales; abdomen slender, smooth; fore wings elongated, pointed, crenulated behind; hind wings rather broad, the hind margin in part deeply scalloped, with long intermediate points.

We have but one species.

1. **H. abruptaria**, *Thunb.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Fore wings crenulated behind, pale brown or wainscot colour, with strong umbreous clouding; a very oblique slender brown line from the middle of the dorsal margin to the apex of the wing is, in its upper half, bordered beneath by a long red-brown blotch; hind wings deeply scalloped behind, similarly coloured, and barred with umbreous.

Antennæ of the male rather shortly pectinated with solid, densely ciliated teeth which taper off at three-fourths the length leaving the apical fourth threadlike, but notched, purple-brown; palpi very short, drooping, dark umbreous; tongue rather small, face smooth, black-brown, edged by a deep channel beneath the antennæ; head rough, and, with a ridge at its back, light brown; collar similar but barred in front with black, in the middle and at the edge with umbreous; rest of the thorax brownish-drab, not very rough; abdomen slender, smooth, pale brown, faintly barred on each segment with umbreous; lateral tufts small; anal tuft slender. Fore wings elongated; costa very gently arched, rather more so before the apex, which is bluntly angulated; hind margin gently rounded and strongly crenulated; dorsal margin straight, ciliated; colour pale wainscot-brown, faintly dusted with purple-brown; costa clouded with rich umbreous; first line often incomplete, double, very oblique but faintly bent back to the costa, umbreous; second line also umbreous, undulating, unusually oblique; arising in the middle of the dorsal margin it *appears* to run into the hind margin below the apex, but this is deceptive, since it really bends sharply back as a very faint thread and proceeds to the costa; from its middle and along its apparent extension to the hind margin it forms the upper edge of a long constricted dark umbreous blotch, broadest at the hind margin; this blotch is continued also to the dorsal margin, but only as a faint soft brown stripe; discal spot small, black; rest of the hind marginal region faintly dappled with purplish-brown clouds; extreme margin dotted with black between the crenulations; cilia purplish-brown. Hind wings moderately broad, the hind margin deeply indented or scalloped and throwing out several sharply-pointed crenulations; pale wainscot-brown, the basal portion stippled with fine transverse umbreous lines; the middle is crossed by a cloudy slender stripe of the same or darker colour, shaded off and immediately followed by a broad black-brown band, edged inwardly by a line of

black crescents, sharply cut off and *concave* outwardly; outside this the hind marginal region is softly tinged with yellow-brown or pale tawny ripples, and the sharp crenulations are slenderly edged with the same; cilia pale brown. Female rather larger and stouter; antennæ simple; wings broader, with the ground colour and markings all brighter and lighter in colour, otherwise similar.

Underside of the fore wings yellow-brown, clouded with smoky purplish-brown to beyond the middle, where is a broad black-brown transverse band throwing off similar clouds to the margin below the apex; discal spot black. Hind wings yellow-brown dusted or stippled with minute purplish-brown lines; central spot black; beyond it is reproduced the slender rippled line of the upper side in crescents with dotted points. Body and legs pale brown.

Casual specimens of a second generation are nearly always smaller in both sexes, of a more dull colour, and the umbreous markings more suffused with smoky-black. A specimen of the ordinary brood, taken in Camberwell some years ago by my eldest son, is also rather small, and its wings narrower than usual, while the transverse lines and dark blotches are rendered distinct and much intensified in colour, and the hollowed stripe of the hind wings is bordered with brownish-*white*. In the cabinet of the late Mr. F. Bond, in Mr. Webb's possession, are two specimens, male and female, entirely suffused with deep dark umber-colour, and almost devoid of markings. For some years past specimens tending very strongly in this direction—uniformly clouded with dark umbreous—have been taken very locally in East London; and from one or more female specimens of the same colour found in North London eggs have been obtained and considerable numbers of this form reared. An example taken by Mr. C. A. Watts in Regent's Park, London, is exactly intermediate, having the dark brown colour, but the markings visible in blacker tints; its thorax and the base of the wings, however, are pale drab; and this peculiarity is usually present in the darkest forms.

On the wing in April and May, and casual specimens of a partial second generation may sometimes be found in July or August.

LARVA.—Head of the same size as the second segment; body cylindrical, gradually increasing in size to the eleventh segment; colour very light brown, mottled with various brown shades; the dorsal line increases in width from its commencement to the middle of the fifth segment, and also deepens in colour; it then assumes a much lighter shade to the eighth segment, becoming darker on the folds of the segmental divisions; on the lighter portions there are two black dots above the middle of each segment, placed transversely; the ninth segment is again darker in colour, especially towards the edges of the line, which is irregularly defined; the tenth and eleventh segments are darker in the divisions; on the twelfth there is a black line running transversely, and assuming the shape of a bow; the sides are mottled with various shades of brown, being darkest towards the anterior portion of each segment, especially the sixth to the ninth; spiracles dark brown; the ventral surface is more mottled than the dorsal, with a black V-shaped mark appearing at the commencement of the fifth to the ninth segments; prolegs slightly tinged with green, and on the first pair is a black line; the bow-shaped line of the twelfth segment continues on the eleventh, running under the eighth spiracle, and a mark of the same colour runs under the ninth spiracle. (Rev. P. H. Jennings.)

Or—Ground colour pale greyish or greenish-drab; segmental divisions pink; down the middle of the back a series of purplish blotches become confluent on the anterior and posterior segments, on the latter almost evanescent; back, undersurface and anal plate sparingly spotted with black; immediately preceding the latter a black belt encircles the whole body; spiracular lines dusky; undersurface greenish with spiracle-like spots in the middle of each segment.

(Rev. H. H. Crewe.) There are indications of two pairs of prolegs, imperfect, in addition to the usual pairs.

May to July or August, on privet, lilac, and currant—but, according to Dr. Hofmann, on *Smilax aspera*, *Genista*, *Cytisus*, and *Jasminum*. In the case of larvæ obtained from eggs of the second generation, the Rev. Joseph Greene recorded that partial hybernation took place, and that they did not assume the pupa state until towards spring.

This larva is well known to be extremely sensitive to the colour of its surroundings, its own colour being greatly influenced thereby.

PUPA long and narrow, cylindrical; eye-covers shining, not prominent; tongue-case rather visible; limb-covers compact and smooth; antenna-covers flattened and broadly sculptured with the form of pectinations; wing-covers laid close, not thickened, nor sculptured, except in the most minute pattern of raised lines; dorsal and abdominal segments sparsely and minutely pitted, but the hind band of each smooth and broad; anal segment fully rounded; cremaster very rough and bristly, and having a long bristly hooked spike; general colour very dark red-brown; bands of the segments pale brown. In a tough silken cocoon, constructed upon the surface of a twig, and covered with morsels of the bark.

The moth sits by day on the flat surface of a tree or paling, with wings closely appressed to the wood, and there bears a most accurate resemblance to a flat chip of wood, or to the place where such a chip might have been broken away; or, if on the trunk of a lilac or cypress, or other shrub, it places itself sideways, with wings straight up and down, and thus perfectly imitates the scar of a torn-off twig or small branch. This should be *seen*, as I have seen it, to be appreciated! At dusk it flies about hedges and shrubberies, and will come, though not commonly, to light. Especially attached to gardens, and nowhere else so common as in those of the

London suburbs; not absent, indeed, from the London squares and parks; found also more or less frequently in suitable places throughout England, except the more northern counties. It is recorded from Westmoreland, and Mr. J. E. Robson has twice taken it at Hartlepool, Durham. So far as I know, this is the extent of its range northward, except that a single specimen appears to have occurred at Stonehaven, Kincardineshire, but whether indigenous or introduced it is impossible to judge. In Wales it is known to be rather common in Carmarthenshire and Pembrokeshire, and probably has a more extensive range. In Ireland it has most probably been recorded in error. Abroad it is not very generally distributed, but is found in Southern France, North-eastern Spain, Southern and Western Germany, Italy, Corsica, the Balkan States, and Bithynia.

Some very handsome, nearly allied, species are found in India, Africa, and North America.

### Genus 37. **HIBERNIA.**

Antennæ of the male weak, notched, pectinated with very thin and finely ciliated teeth, almost like bristles, and often curled in; palpi very small; head rather rough; thorax thin and weak, slightly roughened with raised scales; abdomen slender, smooth; fore wings thin, elongated, with very oblique hind margins; hind wings very thin and weak; rounded, not crenulated. Female apterous, or semi-apterous.

LARVÆ moderately stout, even in thickness, without humps; head rounded.

PUPÆ in the earth, often at the roots of trees or bushes.

We have five species, readily discriminated:

A. Fore wings short and broad, purplish-brown.

*H. rupicaprariva.*



- A<sup>2</sup>. Fore wings long and narrow, dusky-white, marbled with black. *H. leucophæaria*.  
 A<sup>3</sup>. Fore wings ample, orange-yellow. *H. aurantiaria*.  
 A<sup>4</sup>. Fore wings ample, some shade of brown or brownish-white.  
 B. First line curved, second slender, twice bluntly angulated. *H. progemmaria*.  
 B<sup>2</sup>. First line angulated, second distinct, three times angulated. *H. defoliaria*.

1. **H. aurantiaria**, *Hüb.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Fore wings orange-yellow dusted with ochreous-purple; two transverse lines, and a following line of cloudy spots, pale purple-brown; hind wings yellowish-white.

Antennæ of the male short and delicately pectinated to the tips with very fine ciliated teeth, yellow-brown; palpi short, with minute protruding pointed tips, orange yellow; tongue small; eyes jet black; face smooth, purple-brown; head and the slender thorax rather rough, orange-ochreous; abdomen smooth, shining yellow; lateral and anal tufts small. Fore wings elongated, but ample; costa rather straight, but arched towards the apex, which is well rounded; hind margin oblique, smoothly and but slightly curved; dorsal margin a little rounded, ciliated; colour orange-yellow, dusted with ochreous and pale purple, rather pale towards the hind margin; first line nearly erect, faintly purplish-brown; second line rather oblique, not indented, but bent outwards above the middle, very pale purple; between these is a cloudy, straight, similar narrow central shade, nearly parallel with the first line; outside the second is usually a row of cloudy pale purple spots, often broken or nearly obliterated, but representing the subterminal line; discal spot a faint similar streak; cilia pale ochreous. Hind wings elongated, ample, smoothly rounded behind, but the apical and anal angles rather obtusely indicated; pale straw-colour or white with a golden-yellow flush; central spot faintly purple-brown; near

the base is a faint transverse pale purple line, and beyond the central spot another; cilia ochreous. Female sub-apterous, the four minute inefficient flaps of wings brown, barred with dark umbreous, and having very long hairy brown cilia, which are tipped with white; antennæ simple, smoky-black, barred with white; head and thorax light umbreous; abdomen thick, similar, with a yellow dorsal line, the segments barred with dark umbreous, and edged with tufts of white scales; legs dark brown barred with white or yellow.

Underside of all the wings, in the male, rich yellow-ochreous; the discal and central spots purple-black; near the base of the wings is a continuous cloudy obscure purplish stripe, and beyond the middle another, more curved. Body and legs ochreous; the latter barred with dusky purple.

Not very variable, except in the depth of the yellow colour of the fore wings, and the presence or absence of the row of cloudy spots in the subterminal region; but sometimes a faint purple stripe lies along the outside of the second line; while in others the transverse lines of the hind wings are obliterated. In the collection of Mr. G. T. Porritt is a specimen of a distinctly brown colour, taken in Yorkshire.

On the wing from October till December, or occasionally January.

LARVA moderately slender; viewed from above it appears of nearly uniform thickness throughout; but viewed sideways segments seven to ten are rather stouter than the rest; head broad, flattened in front, rounded at the sides, equal in width to the second segment, which, with the two following, is also a little flattened; the fifth more cylindrical, and therefore apparently thinner; skin tough, furnished with a few bristles; back of the second segment glossy, suggesting a sort of plate there; on the twelfth segment is a pair of rather conspicuous warts. The ground colour of the back dull pale ochreous-yellow, and through it runs a number of fine brownish lines, not parallel throughout, but approaching

and receding, so as to form a pattern ; of these two very fine ones down the middle of the back form the dorsal line ; on either side is a darker brown line, and then another wavy one, touching a broad, deep purplish stripe which occupies the side from the head to the twelfth segment, where it is extended upwards, and meeting the stripe from the other side forms a **V**-mark pointing forwards, and bears the two warts, which are of the same colour ; below the broad stripe is a pale yellow thread, and below this a blackish-purple thread ; in the spiracular region the front of each segment is sulphur-yellow ; the hinder part dull ochreous ; here also are indications of two fine purplish lines at the beginning and termination of each segment, but leaving a clear space for the black spiracles ; another line of the same colour below thickens under each spiracle ; undersurface dark purplish-brown, with a central pale yellowish stripe edged with black, opening more widely, and enclosing a short black streak, in the middle of each segment ; through the dark purple ventral stripe is, on each side, a very fine pale yellow line ; head horny, dull red, with a dark grey-brown band across the face ; legs and hinder portion of the anal segment dull brownish-ochreous. (Rev. J. Hellins.)

Extremely variable, the yellow markings on the sides and back assume, in some individuals, the form of regular stripes ; in others are only visible as successive small spots.

March or April till the end of May, or even June ; on oak, birch, hawthorn, hornbeam, elm, lime, blackthorn, willow, and osier ; feeding principally at night, but remaining during the day upon the tree ; falling off and hanging by a thread if disturbed.

PUPA stout in front, tapering rapidly behind, ending in a stout spike with two fine points ; in the male the wing-cases are short and the antenna-cases distinct, showing the pectinations ; the skin smooth and shining, reddish-brown. In a cocoon of brownish silk, slight but close in texture, covered

with fine particles of earth, and placed just below the surface of the ground. (Rev. J. Hellins.) The Rev. Joseph Greene says that it may be looked for best at roots of elm, in the dry corners; and should be searched for in September.

The egg is laid early in the winter, and hatches in the spring.

The moth doubtless hides during the day among dead leaves upon the ground, though an occasional specimen may be found at the foot of a paling or on a tree trunk. At dusk the males fly a little, rather lazily, and later may be found hanging to twigs of hazel, oak, and other bushes, from which they may be removed by the hand. Probably it is more active late at night, and under some unexplained circumstances it will take long flights; indeed, Herr Gatké noticed on several occasions, about the lighthouse at Heligoland, great multitudes of this and the following species, which appeared to have arrived there by a south-south-west wind. The female seems to hide among moss and leaves, and to climb up the bushes at night, where it may be found with the help of a lantern. Usually confined to woods, especially those having open spaces of undergrowth, but also to be met with in open country where there is timber. Not usually considered a very common species, yet found throughout England in woods, and sometimes commonly even so far north as Yorkshire; doubtless also in most parts of Wales. In Scotland it is not plentiful, but is found in suitable spots to Aberdeenshire in the east and to the Clyde Valley in the west; in Ireland scarce, but recorded from Tyrone, Monaghan, and Fermanagh. Abroad its range is small, consisting of Central Europe, Northern Italy, Corsica, Livonia, and Southern and Eastern Russia.

2. *H. defoliaria*, *L.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Fore wings yellowish-white or pale tawny, dusted or banded with dark purple-brown or purple-red; second line thick, black or brown with three obtuse angles; reniform stigma a black

dot. Hind wings brownish-white. Female apterous, with long legs.

Antennæ of the male pectinated with excessively fine, small, yet ciliated, teeth extending to the tips, yellow-brown; palpi minute, dark brown; tongue small; face red-brown; head ochreous; thorax rather rough, slender, yellow-brown, clouded in front with red-brown; abdomen short, yellowish-white, more ochreous behind; lateral and anal tufts dull ochreous. Fore wings elongated, costa almost imperceptibly arched; apex rounded; hind margin but slightly curved, very oblique; dorsal margin rather full, and well ciliated; colour brownish-white, creamy-brown, or pale tawny, dusted, especially along the costal region and median nervure, with fulvous; close to the base is a curved fulvous or tawny cloud; first line slender at the dorsal margin, but above it almost at once spreading into a broad transverse purple-brown band, which also throws back its colour along the costa to the base; second line oblique, thick, thrice bluntly angulated and forming the inner edge of a broad purple-brown or tawny irregular stripe, slightly divided lengthwise by yellower colour, and broken at its outer margin; edging this outside is often a faint white line; discal spot elongated, purple-black; hinder area, beyond the second stripe, clouded faintly with fulvous; cilia yellowish-white spotted with purple-brown. Hind wings ample, rather long, roundish behind, yellowish-white, very faintly dusted with purple-brown; central spot small and faint, dusky-black; cilia pale yellow. Female apparently quite apterous, but furnished with minute, veinless flaps of wings, usually not observable without a strong lens; antennæ simple, yellowish-white, abundantly barred with black; face black; head pale yellow; thorax of the same colour, having six black spots placed in two rows; abdomen thick, but tapering to a long point, pale ochreous abundantly spotted with black; legs black, barred with pale yellow.

Underside of the fore wings of the male pale straw-colour,



tinged along the costa with fulvous; discal spot black; the stripes of the upper side visible in pale purplish clouding. Hind wings pale yellow, dusted with brownish-ochreous; central spot a cloudy blackish dot; cilia pale yellow.

Always extremely variable, and the different forms almost equally abundant—indeed, it is not easy to decide upon the most typical form, and that most clearly distinctive has here been adopted. Even in it hardly two specimens are quite alike—the pale ground colour varies from creamy-white to fulvous, and the stripes through every intermediate shade, from light bright fulvous, through tawny, to deep dark purple-brown, or even to deep unbreous. In another series of forms the pale ground colour is uniformly dusted with red-brown or purple-brown, and the markings, though distinct and running through the shades of red-brown and purple-brown just described, are by no means of the clear distinct sharpness of the typical forms; while in a third series the markings have become obscured, very partial and indistinct, or have totally disappeared, and the red-brown dusting has become a uniform rough red-brown surface speckled with deeper purple-brown. Belonging to the first series, a very curious specimen, taken in Warwickshire by the late Mr. W. G. Blatch, of pale yellow ground colour, has no indication of the second line. In the second series, a race of rather large expanse, taken in Yorkshire, has the fore wings orange-brown, strongly dusted with red-brown, and having the transverse bands broad, very striking, and richly dark brown.

On the wing usually in November and December, occasionally as early as October. Should there, however, be any continuance of severe frost in these months emergence is deferred till January, or even February; this happened in 1864, and to a considerable extent in 1891, and in 1895 be-lated specimens were captured in March.

LARVA moderately stout, head rounded, not shining, dull red; general colour of the back chocolate-brown or reddish-



chocolate; undersurface and sides very conspicuously lemon-yellow from the fourth to the tenth segments; dorsal line grey, inconspicuous; above the spiracles is a conspicuous lateral waved velvety black line, edged above at the incisious with whitish blotches; spiracles white, each in a red blotch; below them is a series of pale streaks with reddish edges; back of the twelfth segment transversely marked with black; legs dull red. (C. Fenn.)

March till the end of May or June, on hazel, oak, birch, beech, hawthorn, fruit trees, and many other deciduous trees; feeding mainly at night, but remaining upon the trees and bushes conspicuously during the day, or, if shaken or disturbed, dropping and hanging by a long silken thread, and in some seasons, in Southern districts, becoming so plentiful that the country-women are sometimes obliged to go round considerable distances, by road, on their journeys into and out of the towns, to avoid the annoyance caused in narrow lanes by hundreds of larvæ swinging about their heads, or catching upon their clothes. It is not a rare circumstance for the undergrowth in woods to be almost stripped of leaves in May by this, most conspicuously, among other species; while the denuded branches and twigs are disfigured by the abundance of silken threads and the pellets of excrement entangled in them.

PUPA elongate, tapering, anal extremity with a doubly hooked bristle; red-brown or dull red. Subterranean, at a considerable depth; not in a cocoon. (C. Fenn.)

The egg is laid in the winter, and hatches in the spring.

The male hides during the day among dead leaves on the ground, or among those remaining for the winter on the oak bushes, but may occasionally be found at the foot of a wall or of a fence or tree, or upon the trunk, and more frequently on the stem at the bottom of a bush. At dusk it flies rather weakly, and almost immediately settles down to sit upon a bush or the twig of a tree, and may easily be collected with the aid of a lantern. It must, certainly on some nights, fly

much more vigorously at a later hour, since it has been seen, along with the last species, to migrate in multitudes. The female is always rather secret in its habits, but may be found, not commonly, in the chinks and interstices of the bark of trees near the ground, or at night sitting upon twigs. Of the tenacity of life and endurance of cold in this insect a curious instance is furnished by Sir Thomas Moncrieffe. "About 11 A.M. on the 6th of December 1871 I was crossing the ice which covered a pretty large pool of water to the depth of three or four inches. The white hoar frost lay all over, and so heavily had it fallen that the leaves and small branches which lay on the surface looked half an inch thick. The trees all around were covered with it, and the whole scene was one of bitter cold mid-winter. A form on the ice attracted my attention, from its shape looking like a large white butterfly. I removed the hoar frost, and there, with outstretched wings, lay a specimen of *H. defoliaria*. It appeared to be dead, and, although the frost lay thickly upon it, it was not adhering to the ice on which it lay. I took it up and placed it on a shelf in the wooden house in which our curling-stones are kept. On entering some hours afterwards, I found my friend on the window, quite lively. Now, this insect must have been a good many hours in the position in which I found it, as the hoar-frost must have fallen at latest about day-break, and most probably some hours earlier."

Its larva is looked upon abroad as one of the most destructive enemies of the fruit trees, and the same has been asserted of it in this country, but in my own experience it is very far more plentiful and destructive in those woods in which the trees are scattered, and the undergrowth is regularly kept down by being cut every ten or fifteen years. In these, every tree and every bush is sometimes defoliated, as already described. Abundant in woods, and present wherever there are trees, over the whole of England and Wales; but far less plentiful in Scotland, though found in Berwickshire, Roxburghshire, and the Tweed and Solway districts generally,

in Ayrshire, Lanark, and the rest of the Clyde Valley with Argyleshire, also in Perthshire, and rarely in Kincardineshire and Aberdeenshire. In Ireland it is found commonly in Dublin County, Wicklow, Cork, Kerry, Mayo, Galway, Fermanagh, Antrim and Derry, and probably in all wooded districts. Abroad it is abundant throughout Central Europe and a great part of Northern Europe, and found in Northern Italy. Moreover, in North America, at Vancouver Island, it is found commonly and in similar variety, and its larva, not varying from our forms, abundantly upon cherry and plum-trees. Upon this subject there is a long article in the *Canadian Entomologist* for 1894.

3. **H. progemmaria**, *Hub.*; **marginaria**, *Staud. Cat.*  
—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings pale ochreous-brown with smoky suffusion, and a dark smoky central shade; second line forming the inner edge of a red-brown stripe, twice obtusely angulated; hind wings dusky white, tinged with tawny behind. Female semi-apterous, having small useless lobes of wings, the hinder lunate.

Antennæ of the male pectinated to the tips with short, well ciliated teeth, pale brown; palpi very small, pointed, purplish-brown; face of the same colour; top of the head paler brown, both rather rough; thorax slender and weak, yellow-brown; abdomen short and small, pale yellow dusted with brown; lateral tufts very small, anal tuft narrow. Fore wings somewhat elongated; costa nearly straight, except that it is arched before the apex, which is rounded; hind margin gently curved, long and oblique; dorsal margin faintly rounded, ciliated; colour dull pale yellow-brown, ochreous-brown or pale tawny, in any case clouded or dusted with smoke-colour; first line erect, indented, very slender, black-brown; second line rather erect from the dorsal margin, but bent out and up above the middle, brown-black; between them is a straight, erect, smoky-black or smoky-brown central shade, not always visible; a blackish crescent indicates the

discal spot; hind marginal region from the second line often broadly pale purple-brown, or else equally divided into a band of this colour, and a paler outer band of similar clouds on the ground colour, the division, which often presents a row of paler dots, being the subterminal line; hind margin regularly dotted with black; cilia yellow-brown. Hind wings rather long, somewhat squared at the angles and but little rounded behind; colour silky-white, minutely and faintly dotted with purple-brown; often with a slender, very obscure and very oblique, transverse dusky line near the base; and below a slender similar but nearly straight central line, immediately above which the central spot is just visible as a dark dot; hind margin faintly dotted with purple-black; cilia white, clouded faintly with pale purple. Female stout, with the abdomen almost ovate and pointed; antennæ filiform; the small flaps which represent the fore wings curiously shaped and squarely cut off, pale yellowish-brown with the first and second lines visible, dark brown; hind wings still more curious, rounded off in front, elongated behind, so as to form a crescent-like or sickle-shaped lobe of the same colour, barred in the middle with dark brown; abdomen thick, pale brown with a whitish dorsal line, and numerous short black cross-streaks on the sides; legs long, light brown shaded with darker.

Underside of the fore wings of the male whitish-brown with smoky shading, rather browner toward the costa; discal spot and second line cloudily indicated; hind margin yellowish-white dusted with pale purplish-brown; central spot distinct, black-brown; hind margin of all the wings regularly dotted with black. Body and legs very pale brown.

Variable in the degree of smoky clouding of the fore wings, some specimens being quite without it, others devoid of it so far as the second line, while many have the suffusion over the whole wing; every intermediate shade occurring. In Ireland the same shades of smoky clouding are found with

a much deeper ground colour of red-brown, and a decided tendency in the same direction exists in the western and more northern districts of England. As in some other species, a peculiarly dark form has made its appearance in South Yorkshire, probably within the last forty years. Mr. G. T. Porritt, who has been paying attention to it at intervals for more than twenty years, tells me that in woods near Huddersfield, where it used occasionally to occur among abundance of typical specimens, it is now comparatively common. In it the fore wings have become smooth shining dark fuscous, or black-brown, the thorax the same colour, while the hind wings in some individuals are still pale, but in the majority are deeply tinged with smoky-black; all the markings in both having disappeared. The females seem to have assumed this tendency still more strongly, for nearly every specimen in the same localities is now dark, the body and basal half of the winglets being sooty-black and the outer half dark brown or smoky pale brown. With the males are intermediates between these and the normal forms, but such in the case of the females seem rare. The dark race appears to be spreading, since it has now been taken near Leicester, near Birmingham, and in Derbyshire, as well as in plenty at Huddersfield, Rotherham, Wakefield, and elsewhere in South Yorkshire. Scottish specimens do not appear to partake of this darkening tendency.

On the wing in March and April.

LARVA elongated, cylindrical; head flattened in front, dusky-red, the face spotted with black, and having a whitish transverse line above the mouth; general colour dull yellow, olive-green, or greenish-brown; a series of dark grey X-like dorsal markings is most distinct on the sixth to the twelfth segments, on which last is a black transverse line; on the anterior segments is a broad purplish or greyish subdorsal shade, sometimes with a faint geminated yellowish dorsal line; spiracles white, each placed in a black cloud, the inter-



vening spaces paler, sometimes yellowish ; no marking upon the anal segment, which is often pale brown ; undersurface paler than the back and sides, with a faintly lighter central stripe ; usual raised dots black or dark grey ; legs reddish. (C. Fenn.)

In the district already alluded to, in which the darkest forms of the moth are obtained, dark or even blackened varieties of the larva also are not infrequent.

April and May, sometimes to June and even occasionally July ; on oak, hawthorn, blackthorn, birch, beech, hazel, poplar, willow, alder, rose, maple, and other trees, sometimes even on laurel ; feeding principally at night, but remaining upon its food plant during the day ; and forming no inconsiderable portion of the vast army of larvæ which in some seasons defoliates the more open woods.

PUPA stout, tapering slightly behind ; anal extremity furnished with a long spike ; back and abdomen mahogany-red ; wing and limb-covers green. Subterranean, in a long brittle earthen cocoon. (C. Fenn.)

The male moth sits by day on palings, tree trunks, or the lower stems of bushes near the ground, or else among dead leaves, usually those which have fallen ; but flies gently at dusk and soon after may be found, by means of a lantern, sitting upon bushes or tree-trunks, very conspicuous from the whitish appearance of its weak erect wings as the wind moves them. The female hides during the day in similar places, but particularly in the deep interstices of bark of trees, and crawls up at night. The male, unlike other species in this genus, will come to the blossoms of willow, and sits upon them, complacently sucking, with small regard to the collector's lantern ; but it is noticeable that the nights which it selects for this feast are usually those upon which the ordinary revellers, the *Taniocampæ* and other *Noctuæ* are not attracted. It is known to fly, at times, at night during somewhat sharp frost. Most numerous about open woods,



but found wherever the ordinary deciduous trees and bushes are plentiful, and abundant throughout England, Wales, and Ireland. In Scotland it is common in the South, but in the West hardly extends beyond the Clyde Valley, and in the East only to Aberdeenshire, where it is scarce. Abroad its range is considerable, through Central Europe, Central and Northern Italy, Livonia, and the Ural mountain district.

4. *H. leucophæaria*, Schiff.—Expanse of male  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings long and narrow; yellowish-white, dusted with brown or black; lines distinct, black; spaces before the first, and beyond the second, usually dusted with brown or clouded with black. Hind wings white with black dusting. Female practically apterous.

Antennæ of the male pectinated with short ciliated teeth, set widely apart, brown; palpi minute, pointed, brown; head and face hardly roughened, pale grey-brown; thorax very slender and weak, pale brown, dotted with black; abdomen brighter brown, dotted with black; tufts small. Fore wings of thin texture, much elongated; costa nearly straight; apex very fully rounded; hind margin very oblique and its middle portion almost straight; dorsal margin softly rounded, ciliated; colour greyish-white, or yellowish-white dusted with brown or black; first line black, much curved, and usually enclosing a brown or blackish basal blotch; second line also black, sometimes slender, often thickened in the middle, irregular, having in its length two strong outward curves and being very oblique; between these is a straight and more erect narrow brown central shade, blackened upon both margins; space outside the second line much clouded with brown or purplish-brown, or black; through it meanders a whitish subterminal shade or series of small clouds, broadened near the apex; cilia light brown dashed with darker. Hind wings rather long and narrow; rounded behind; white, dusted with brown and having faint indications or commencements of brown transverse lines confined to the

dorsal region; cilia whitish-brown. Female very nearly apterous, the wings being only represented by minute black-brown narrow flaps; antennæ simple, reddish-brown; head and thorax dark brown with a hoary tinge on the upper surface; abdomen short and thick, black-brown, faintly dusted on the anterior segments with red and hoary scales; legs brown, the tarsi blacker and barred with pale brown.

Underside of the male dusky white, dusted with brown, the fore wings showing cloudy or smoky indications of the dark markings of the upper side; hind wings much dusted with olive-brown. Body and legs pale brown.

Always and everywhere variable, and usually in certain lines, as in part already indicated. In the paler forms the portion of the fore wings between the first and second lines is occasionally white, but usually dusted, as already described, with brown, the other portions ranging in every shade from the palest possible brown clouding through every degree of darker brown or blackish clouding and dusting, the colour sometimes scattered into cloudy blotches, in other cases forming a broad dark transverse band attached to the second line, the rest of the wing paler in various degrees. In these forms very often the two transverse lines are slender—mere edges of the dark colour—but occasionally they are thick, black or deep brown and very conspicuous. The most striking and constant variety is different from those described, its base and the broad band outside the second line are black, conspicuous and brightly marked, the hind marginal area also black or clouded with the same; the central band sometimes brightly white, but often having a little black dusting, yet usually without the central shade. Another and far less common form has the black or black-brown clouding extended also to the central band, so that the fore wings are of a uniform dark colouring, yet not smoothly so, the markings being only coarsely obscured. A specimen taken in Richmond Park by Mr. Percy Richards has the fore wings wholly of a curious vinous colour, a shade of purple-red-brown, darkest

from the second line to the hind margin. In the late Mr. N. Cooke's collection, in the Liverpool Museum, is one in which the ground colour is of a clear white without markings except sharply black first and second lines. In an example in the collection of Mr. H. J. Turner these two lines coalesce below the middle. One taken by myself in Pembrokeshire has the fore wings of a rich soft pale yellow without dusting, but the two lines black, each edged by a clonding of pale chestnut, and the central shade distinctly visible. In the collection of the late Mr. H. Doubleday, in Bethnal Green Museum, is a reddish-grey specimen, and several of a clear grey, without markings. Finally, Dr. Mason possesses a very perfect gynandrous example, its left side male, with well developed wings, the body, moreover, almost as slender as that of a male, but the right side blackened, and the minute flap of a wing just visible.

On the wing in February—usually at the middle of the month—but in very forward seasons at the end of January, and in very late ones in March.

LARVA rather squarely built, being stout and of uniform size throughout; very pale yellow-green, or very pale olive-green, with a yellowish dorsal line, double, but very nearly running into one at the segmental divisions; subdorsal lines rather paler; some specimens, in addition, are dotted with yellowish-white.

Or—Pale pea-green with dorsal and subdorsal lines like the last, and having an elongated dark brown dash immediately below the subdorsal lines, on each segment from the fifth to the ninth.

Or—Ground colour very pale drab; dorsal and subdorsal lines pure white; on each side of the second segment, behind the lobes of the head, is a blotch of dark brown; down the back, in the middle of each segment, a triple, wedge-shaped, dark brown mark; and at each segmental division a black spot; the subdorsal lines bordered, on their undersides, throughout, with dark brown dashes.

Or—Ground colour yellowish-green, full green, or sometimes dark olive; dorsal and subdorsal lines varying with the ground colour, in the darkest specimens becoming much suffused, and interrupted at the segmental divisions by a dark brown transverse band; two large round dark spots on the second segment; on the back of each of the other segments a dark brown mark, compared by Mr. Buckler to two leaves pointing forward, with a short stem between them; and preceded by two black dots; subdorsal lines bordered below with dark dashes. (Rev. J. Hellins.)

Another variety has been figured by Mr. Buckler in which the ground colour is pale purple, with similar markings; and it is not easy to indicate the full extent of fluctuation in colour to which this larva is liable.

April to the end of May or beginning of June on oak, when very young hollowing out the buds; afterwards drawing together two leaves with a few threads of silk for concealment, and feeding upon the leaves; when well grown feeding exposed. Hofmann states that it also feeds on aspen.

PUPA dull reddish-brown; provided with a slender spike on the cremaster. (Hofmann.) Not further described. In the earth. The winter is passed in this state.

The moth sits in the daytime on the trunks of trees, preferring, besides oaks, Scotch fir, or birch-trees where these are available, especially during cold or windy weather, when it squeezes closely into the great chinks of the bark and sits as flatly pressed to the surface as possible. Also it loves the dead leaves which stick so long upon oak bushes, and sometimes on the trees, hiding in the same manner in the hollows of the crumpled and withered leaves, but from these it may be beaten out, and if the weather is sunny or very mild, may then be induced to fly hurriedly away, to settle on similar dead leaves, or on those lying upon the ground. Where a fence is suitably situated it is not despised. The

female sits in similar situations, but conceals itself closely and is hard to find. The male flies at late dusk, apparently about the trees, since it is then seldom captured on the wing. Almost confined to oak-woods, and parks largely planted with oak timber; and in such situations to be found, locally, sometimes abundantly, almost throughout England, though but rarely in Cornwall. In Wales I have found it commonly in one oak-wood in Pembrokeshire; but find no other records. In Scotland it occurs in a similar local manner in the Southern districts, extending to Aberdeenshire in the East and to the Clyde Valley in the West. In Perthshire Sir Thomas Moncrieffe found it commonly, and noticed that at Moncrieffe Hill it seemed particularly attached to the sycamores. In Ireland its presence is doubtful. Abroad it occurs throughout the greater part of Central Europe, in Central and Northern Italy and Galicia; but must also have been surely overlooked in some parts of Asia, since it occurs in similar varieties, and sometimes in larger size, in Japan.

5. *H. rupicapraria*, *Schiff.*—Expanse of the male  $1\frac{1}{2}$  inch. Fore wings short and broad, silky purple-brown, with two paler transverse lines inwardly margined with black-brown, and a black discal spot. Hind wings smoky-white. Female sub-apterous.

Antennæ of the male pectinated with very delicate ciliated teeth, pale brown; palpi minute, brown; tongue very small; head rather rough, dark brown; collar of the same colour; thorax slender and weak, rather paler brown, dusted with black; abdomen slender, short, and smooth, whitish-brown; tufts obscure. Fore wings short and broad; costa gently arched; apex bluntly angulated; hind margin long and very little curved; dorsal margin slightly filled out and much ciliated; colour purple-brown, minutely dusted with black; first line obscure, curved, paler purple-brown edged with black; second line similar in colour, rather direct, very little



oblique, but faintly notched throughout, and edged outwardly with a faint line of white; discal spot elongated, nearly black; hind marginal area faintly paler than the rest of the wing, and containing an almost imperceptible whitish irregular subterminal line; cilia purple-brown. Hind wings long, ample, thin, silky-white faintly dusted with smoky-brown, more so along the dorsal margin; beyond the middle is a slender, faintly smoky-black transverse line; central spot minute, smoky-black; cilia smoky-white, dusted with brown. Female provided with very small flaps representing wings, the fore pair squared behind, and the hind narrowed to mere straps, all silvery-grey dusted with brown, and having a purple-brown transverse stripe; antennæ simple, brown, whiter towards the base; head, thorax, and abdomen (which is not very thick) brown, with a hoary shade on the upper surfaces; legs dark brown, barred with white.

Underside of the fore wings of the male whitish-brown, browner along the costal region; discal spot black; beyond it is a partial black transverse line from the costa, reaching half-way across the wing; region beyond it clouded with smoky-brown; hind wings whitish-brown, dusted with purple-brown; central spot elongated, black; beyond it is reproduced the slender transverse line of the upper side. Body and legs brown.

Hardly variable, except that in Scotland the ground colour is darker.

On the wing in January and February, and occasionally in the beginning of March.

LARVA. Head and body of nearly equal width; the body velvety and without humps or warts; in colour the variation is extreme; the head usually semi-transparent apple-green; the more usual colour of the body glaucous-green, approaching to white on the dorsal surface, and to apple-green on the ventral; the white appearance of the back is partially due to the presence of whitish stripes, of which the more conspicuous



pair extend on each side from the head to the anal extremity, and divide the dorsal area into three nearly equal parts; the other white markings are irregularly arranged in waved linear series, often imparting a reticulated appearance to the surface; at each interstice of the segments adjoining the principal white stripes are blotches of darker or olive-green; spiracles extremely small and inconspicuous, pale brown with a darker margin.

In the varieties, some of which are extremely beautiful, all the parts usually pale green have become extremely dark bottle-green or almost black, the white markings remaining almost unaltered, and being thrown up in strong relief by the contrast. (E. Newman.)

In the darker varieties figured by Mr. Buckler the middle and hinder segments are barred across the back with black, black-brown, or greenish-black.

April and May, on hawthorn and blackthorn; occasionally on heath or whortleberry, feeding up rapidly.

PUPA yellow-brown; with two divergent hooks on the wart-shaped cremaster. In the earth. (Hofmann.) Not further described. In this condition during the first portion of the winter.

The moth conceals itself during the day among dead leaves at the bottom of a hedge, or on the ground, and at dusk flutters or crawls up—the female certainly crawls—the male flies so short a time that its flight is hardly noticed—but as soon as it is dark both sexes may be found sitting on the outermost twigs of hawthorn bushes in the hedges, particularly in country lanes. Sir Thomas Moncrieffe states that it has been taken *paired* on the wing, and he suggests that it is in this manner that species having small apterous females are distributed about the country. This suggestion has been adopted and confirmed by other excellent observers, and it may possibly be correct, but I have for years sought to find *certain* evidence of this fact, and have not succeeded. The

circumstance seems to have been overlooked that the female is much in the habit of crawling to the outermost spray of a bush before pairing, which occurs late at night, and that in this position it is very easy to sweep both moths off into the net unconsciously; and also that while so sitting on a twig the wings of the male flutter in any breeze, and deceive the eye in the darkness, so that it appears to be flying when it is not so. This latter circumstance I have myself seen, and I still feel doubt of the ability of the male to carry the female through the air. Certainly nothing can well exceed the sluggishness of the male in this species; and it, like the female, is readily beaten off the hedge into an umbrella early in the evening and before pairing.

Common in lanes, fields, orchards, and garden hedges over the whole of England, and doubtless throughout Wales; but apparently not extending beyond Perthshire and the Clyde Valley in Scotland. In Ireland recorded from many localities, and probably to be found everywhere. Abroad its range is over the greater portion of Central Europe, Northern Italy, and Armenia.

### Genus 38. **ANISOPTERYX.**

Antennæ of the male thinly subpectinated with bristle-like teeth; palpi minute; head rough; thorax smooth, but shoulder-lappets a little raised; abdomen slender, smooth; fore wings thin, narrow, long, almost triangular, laid one upon the other when at rest; hind wings long, weak, and thin. Female apterous.

We have but one species.

1. **A. æscularia**, *Schiff.*—Expanse of the male  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Fore wings long, triangular, silky, thinly scaled, pale grey-brown; the two transverse lines smoky-black edged with yellowish-white, the second rippled; hind wings silky-white. Female apterous, and having a large anal tuft.

Antennæ of the male hardly pectinated, strongly notched

on each side, and each notch surmounted by a dense tuft of fine bristles resembling small pectinations; between these thickly ciliated, pale brown; palpi minute, brown; head and thorax smooth, silky, pale grey-brown dusted with white; abdomen small and slender, reddish-brown, each segment edged with white scales; anal tuft tipped with white. Fore wings elongated; the costa scarcely at all arched; except towards the apex, which is suddenly rounded; hind margin very oblique and as long as the dorsal, both being gently curved and fully ciliated; colour pale grey, or whitish-grey, dusted with brown; first line faintly irregular, and notched, smoky-black, edged inside by a whitish shade; second line very oblique but sharply bent back to the costa, smoky-black, slender, formed entirely of small crescents with sharp blackened points, edged outside with a silvery-white stripe which forms a white cloud on the costa; from the bend of the second line an irregular black or brown line runs into the apex of the wing; discal spot elongated, black; costal region dusted with yellow-brown, more decidedly so at the apex; hind margin clouded with grey, and faintly dotted with black; cilia glossy, rather long, pale grey mixed with white. Hind wings elongated, rounded behind, very thin and silky, white; central spot round, obscurely black; beyond it is a faint indication of a bent smoky-black transverse line; cilia white mixed with grey. Female quite wingless, antennæ simple, whitish-brown; head purple-brown; thorax and abdomen glossy, together ovate, yellow-brown; anal tuft suddenly large and conspicuous, very dense, olive-brown. Legs reddish-brown.

Undersides of all the wings of the male silky whitish-grey, the discal spots, and following lines, faintly reproduced in grey. Body and legs pale brown.

Usually very constant in colour and markings, only differing a little in their shades of brown or grey, and in their intensity. In Yorkshire blacker specimens are obtained, either wholly suffused with darker colour, or having the

white edgings of the transverse lines visible. In the collection of Mr. Robt. Adkin is one of a smooth unicolorous whitish-brown, devoid of markings except towards the apex.

On the wing from the end of February till April, or even, rarely, till the beginning of May.

LARVA moderately stout, sides wrinkled; head rounded; two minute retractile tubercles on the undersurface of the ninth segment; head pale green, mouth dark brown; body pale green; dorsal line faintly darker; subdorsal and spiracular lines distinct, yellowish; between them is an interrupted whitish line; spiracles black; ventral tubercles tipped with black.

Very like that of *Cheimatobia brumata*, but larger; it maintains a different attitude, a more open arch, upon its food. (C. Fenn.)

A variety figured by Mr. Buckler has a series of black spots down the dorsal line, and the spiracles distinctly black.

The pair of ventral tubercles mentioned above is regarded by some writers as a pair of ill-developed feet upon the ninth segment.

April and May, in more northern localities extending into June; on hawthorn, blackthorn, oak, beech, hornbeam, ash, privet, rose, lilac, and cherry; feeding at night; remaining upon its food during the day.

PUPA rather short, moderately stout, the eye-covers rounded and swollen; antenna-cases conspicuous, faintly cross-barred with small hollows; limb-cases compressed; wing-covers a little swollen, dull, but scarcely in the least sculptured; dorsal and abdominal segments rather swollen and rounded up, smooth and shining; cremaster hardly noticeable on the much-rounded anal segment, but provided with a fine bristle. In a strong small ovate cocoon of silk and earth, underground.

The eggs in this species are sometimes placed curiously, like those of *Clisiocampa nevustria*, in a ring round the twig of the food plant; they are protected by the hair-scales from the anal tuft of the female, which are placed endwise round them, standing out in a loose hairy surface.

The moth sits during the day, occasionally on a fence or tree trunk, but much more commonly among dead leaves or in the thick tangle of a hedge; the male flies at dusk along hedges and comes willingly to light, being very often to be seen upon a gas lamp, where its appearance is quite unmistakable; its wings are so closely drawn down that it is quite as narrow in form as a *Noctua*, and its fore wings are thus so crossed and overlapping that their tips show themselves in this unusual position. The female may sometimes be found sitting on a twig in a hedge at night, but is much protected by its small size and obscure appearance. Not restricted to woods, but found quite as commonly in open cultivated districts, in lanes and roads—even orchards and gardens having rough hedges—apparently common in almost all parts of England and Wales, yet less so in the more Western and extreme Northern counties; common also all over Ireland. In Scotland found in Berwickshire, Roxburghshire, and doubtless over the whole of the more Southern portion, and extending to Renfrew, Argyleshire, and Perthshire. Beyond these I find no record. Abroad it seems to have but a limited range, through Central Europe, and Central and Northern Italy.

#### Genus 39. **PACHYCNEMIA.**

Antennæ simple; palpi prominently pointed; head small, smooth; thorax and abdomen very slender, smooth; fore wings long and narrowly ovate; hind wings elongated, thin in texture.

We have only one species.

1. **P. hippocastanaria**, *Hüb.*—Expanse  $1\frac{1}{8}$  to  $1\frac{1}{4}$  inch. Fore wings long ovate, slate-grey, with the nervures darker, and the two transverse lines greyish-white; hind wings large, greyish-white.

Antennæ of the male simple, rather thick, minutely ciliated, dark brown; palpi pointed, slender, but slightly projecting, dark grey; tongue very small; head and thorax slate-grey abdomen slender, smooth, pale yellow-brown; lateral tufts minute; anal tuft pointed. Fore wings elongated, narrowly ovate; costa much arched; apex bluntly rounded, almost angulated; hind margin short, curved and oblique; dorsal margin rather rounded, slightly ciliated; colour dark slate-grey, the nervures obscurely blacker, and the surface dusted with minute white scales; first line sharply angulated outwards, blacker grey, more blackened on the nervures, but edged inwardly with cloudy white; second line white, rather oblique, but curving up from the middle, disposed throughout in short curves, along with which are minute dark streaks on the nervures; discal spot black; close to it is a faint cloudy-black central shade; hind margin dotted with black; cilia silvery-grey. Hind wings large and rather long, rounded behind; thin and silky; dusky white faintly shaded with grey along the hind margin; central spot minute, black. Female accurately similar, with body only a very little stouter.

Underside of the fore wings glossy brownish-grey; discal spot just perceptible; as is a faintly darker indication of the second line. Hind wings shining, dusky white, shot with very pale brown. Body pale grey; legs grey.

Extremely constant in colour and faint markings.

On the wing in April and May, and as a partial second generation in August. In an unusually forward season it has been taken in March.

LARVA. Head semi-prone, wider than the second segment, and not notched on the crown; second segment dilated in



front to receive the head ; body otherwise almost uniformly cylindrical, wrinkled transversely, has an interrupted lateral skin-fold, and is garnished with sprinkled bristles ; colour of the head pale semi-pellucid brown, irrorated with black dots, most of which are arranged in an ill-defined stripe on the middle of each cheek ; colour of the body grey-brown, with numerous black dots which form very irregular and interrupted rivulet lines down the back ; there are also six series of small blotches of a rich mahogany-brown, like the nut of the horse-chestnut when recently exposed ; two of these are dorsal, two lateral (one on each side), and two ventral ; there are also on the ventral area, between each pair of chestnut blotches, two closely approximate black streaks ; these streaks are connected in double pairs, thus forming two interruptedly approximate ventral series ; legs pellucid pale brown, sprinkled with black dots ; ventral prolegs grey dotted with black ; anal prolegs of the same colour, with a whitish exterior streak. It rests in a straight and stick-like position attached by its prolegs to its food plant, the rest of the body standing straight out, and so exactly resembles the twigs of the ling, in size and colour, that it is impossible for the uneducated eye to detect it.

June and July, and a partial second generation in September and October on *Calluna vulgaris* (heather or ling) ; feeding at night.

The moth hides during the day among heather, clinging closely to the stems, and almost clasping its wings round them ; the wings are so drawn down that the fore pair almost entirely overlap, the hind are unusually folded, and the creature almost resembles a narrow half-cylinder. If the sun is very hot it may sometimes be trodden up, when it will fly a short distance, to hide again in the same manner. Just after sunset, when the multitudes of *Gelechia ericetella*, *Pleurota bicostella*, *Fidonia atomaria*, and other common species have settled down to rest, and the heath seems bare

of life, it is curious to see this insect climbing to the highest point of a tuft of heather, and there waving its wings like small flags before essaying its first flight; then in another minute or two to see the whole heath alive with them flying gently and conspicuously in every direction, in numbers that admit of several being swept up at a stroke of the net, while others flit past or seem to sit on the tops of the heather to watch the boxing of their comrades. When caught they usually drop to the bottom of the net with closely rolled wings, a wonderful contrast to the size and conspicuous appearance of the flying specimens; but very soon arouse themselves and attempt to escape. The flight seems to be at an end with the twilight, but I believe that it is resumed later in the night. It takes place in still warm weather, and on a cold evening not a specimen will be seen.

Quite confined to open heaths, avoiding any shelter of trees, and extremely local, but abundant in such favoured spots in Kent, Surrey, Sussex, Hants, Dorset, Berks and Somerset, and found rarely in Suffolk. So far as I know, this is the limit of its range in the British Isles. Abroad it is found in Western and a great part of Southern Europe, including Corsica; also in Central and Southern Germany, Switzerland, the South of Spain; Algeria, and other parts of North Africa; and in Asia Minor.

#### Genus 40. **PSODOS.**

Antennæ simple, palpi densely tufted with projecting hairs; head and thorax shaggy; abdomen hairy, short, blunt and rather thick; fore wings narrow, extremely silky; hind wings elongated, silky and rather hairy.

We have but one species.

1. **P. coracina**, *Esp.*; **trepidaria**, *Stainton, D.L.*—  
Expanse  $\frac{7}{8}$  to 1 inch. Slender, very hairy, black; fore

wings rather small, shining silvery-grey, with black clouding and tranverse lines; hind wings very similar, but a little paler. Female more silvery-grey.

Antennæ of the male simple, rather thick, almost imperceptibly ciliated, shining brown-black; palpi of moderate size, but hidden by abundance of long projecting black hair-scales; tongue long; head densely and prominently tufted with black hair-scales; thorax shining black; abdomen smooth, velvety, black-brown; anal tuft small. Fore wings narrow; costa arched throughout; apex bluntly angulated; hind margin gently rounded; dorsal margin almost straight; colour shining smoky-black, dusted with white; first line deep black, much indented, and placed in several curves, edged and shaded off inwardly with silvery-white; second line not very oblique, but deeply angulated inwards just above the dorsal margin, and indented throughout, black, edged and shaded on the outside with white; the space between these lines forms a darker central band, and contains the discal spot, which is ovate and deep black; subterminal line silvery-white, much indented and often obscured; extreme hind margin dotted with black, and sometimes alternately with silvery-white; cilia smoky-black, shot with pale grey. Hind wings rather elongated and narrow, rounded behind, smoky-black; central spot round, black; just beyond it is an obscure transverse whitish stripe; beyond this another, undulating and rather scalloped, partially connected with a third which lies along the hind margin, all being formed of rather scattered white scales; cilia long, smoky-brown. Female stouter, but with more slender antennæ; the silvery-white shadings and lines of the wings broadened, and much more suffused, so that the ground colour of the fore wings often is almost silvery-white, with only the two lines black; the hind wings also paler.

Underside of the fore wings smoky-black to the middle, or even to beyond the discal spot; in the hind wings to the middle; this in each case is abruptly cut off, the remaining

space being smoky whitish-grey with a yellowish gloss. Body and legs black.

Very variable in the degree of silvery-white shading, which in the male is often almost absent, in some specimens the wings being nearly unicolorous smoky-black. Also there is a strong tendency to approximation of the first and second lines below the middle, and to their being joined together by a black bar near the dorsal margin. Sometimes the two lines actually join, and the central dark band becomes broken into a large costal and a small dorsal blotch; this is finely shown in specimens in the collection of Mr. R. Adkin where also are others having this peculiarity in one wing only, the other being normal.

On the wing in June and July.

LARVA and PUPA apparently quite unknown.

The moth is an inhabitant of the higher mountains, its favourite altitude being from 2000 to 4000 feet above sea level, though it has been found as low down as 700 feet. Here it flits about in a very lively manner in the sunshine, every now and then settling, to sun its wings, on some mountain plant or on the rocks. On one of the mountains in Perthshire Mrs. Fraser found it, in numbers, on one flat-topped eminence, where some of the rocks were black and others grey, while on the ground the peaty earth of the boggy spots was enlivened with grey lichens. Here she particularly observed that the blacker males chose the black rocks for resting upon, where they were practically invisible; and that the more smoky and paler males settled invariably upon the browner peat; while the more silvery-grey lichens were the chosen resting places of the females.

Curtis (*Brit. Ent.*) says that it was first discovered before the year 1825 by Dr. Hooker upon the summit of Schehallion, Perthshire; the only plants being *Trichostomum lanuginosum* (fringe moss) and *Splachnum fastigiatum*. Richard Weaver, who found it on that and another mountain—probably Craig

Cross—twenty years later, wrote of it: “The best time for capturing these moths is when the sun shines a little, but the weather is otherwise cold; they may then be seen running over the surface of the moss; when approached they almost invariably ran in among moss which was nearly of their own colour, and secreted themselves. The females were much more rare than the males.” I am not aware that this habit of *running* over the moss in cold sunshine has been again observed.

Its range in these Islands appears to be limited to the mountains of Perthshire, Inverness, Aberdeenshire, Banffshire, Sutherlandshire, Ross-shire, and Argyle. Abroad it is found in Norway and Lapland, the mountains of Galicia, and the summits of the Alps and Pyrenees.

#### Genus 41. **ABRAXAS.**

Antennæ simple, strongly ciliated in the male; palpi minute; head small, smooth, rather depressed; thorax not stout, smooth, but with loosely raised shoulder-lappets; abdomen smooth, very cylindrical and even in thickness; fore wings broadly ovate, devoid of the usual defined lines; hind wings broad and rounded; all weak in texture, their margins even.

LARVÆ rather short and thick, without humps, brightly coloured, and with black markings.

PUPÆ in slight cocoons; upon the food plants and neighbouring objects, or among rubbish on the ground.

Our two species are perfectly easy to discriminate, the ground colour of all their wings is white; *A. grossulariata* has a yellow stripe and numerous black spots; *A. ulmata* faintly a cloudy-grey stripe, and large rounded bistre-brown blotches.

1. **A. grossulariata**, L.—Expanse  $1\frac{1}{2}$  to  $1\frac{7}{8}$  inch. All the wings white; at the base of the fore wings, and again

beyond the middle, is a double series of black spots enclosing an orange-yellow stripe; hind margin and also hind wings sprinkled with large round black spots.

Antennæ of the male rather short, simple, a little thickened, densely ciliated, black-brown; palpi minute, dark-brown; tongue well developed; eyes black; head deeper black, smooth; thorax black, except that the collar is rich orange-yellow, and the raised shoulder-lappets paler yellow; abdomen smooth, orange-yellow, with a large black spot on the back of each segment, and another on each side; lateral and anal tufts rich orange. Fore wings very broad; costa decidedly arched; apex rounded; hind margin not very oblique, and but very slightly, though smoothly, rounded, more so in an even curve round the anal angle; dorsal margin slightly filled out, and decidedly ciliated; colour white; at the extreme base is an orange dot enclosed by a black angulated spot, this being equally clasped by a curved short orange stripe, which suggests a sort of basal line, and is itself margined with black spots which suggest a stripe; beyond the middle is a double series of round black spots enclosing an orange stripe, all which together follow the usual shape of an ordinary second line in being obliquely curved outward and bent in again toward the costal margin; preceding these is a large black spot on the costa, which unites with another representing the discal spot; below this two isolated black spots indicate the position of the usual central shade; along the hind margin is a row of equally conspicuous round, or ovate, black spots; cilia short, dull black when touching the spots, white between them. Hind wings very ample and smoothly rounded behind, white; central spot round, black; beyond it some scattered similar spots indicate a sort of transverse stripe; and a conspicuous row of larger ones lies along the hind margin, affecting the cilia, as in the fore wings. Female a little stouter; the antennæ more slender, otherwise quite similar.

Undersides of all the wings white, with the black spots of the



upper side repeated and equally distinct, though not of so glossy a black ; but the orange stripes very faint ; a broad stripe of very pale yellow lies along the costal margin. Body orange-yellow ; legs purplish-brown.

Excessively variable, in the number of black spots, in their size, and in the degree to which they are separated or massed together—but the inner row of the series occupying the position of a second line is usually united in some degree, and often becomes a stripe, or broken stripe, with hardly a semblance of the round spots. Beyond this, variation seems to be rather local in its distribution. In South Wales I have found the ground colour rendered dusky by a thick, or thin, sprinkling of minute black dusting over the white surface ; in the fens of Norfolk a tendency to blackening of the fore wings by the running of the black spots into elongated stripes along the nervures ; and in many southern districts to diminution of the black spotting so that the white surface is greatly increased, and consequently the general brightness of the insect is enhanced. But it is to Lancashire and other North-western districts and South Yorkshire that we are mainly indebted for a knowledge of the capabilities of this species for extreme variation ; and to describe all the results of the constant rearing of specimens for many years would tax the energies of the most laborious and diffuse writer. In the majority the markings of the fore wings are altered by the extension and massing together in every possible degree of the black markings, sometimes in very broad, or doubled black bands, sometimes in a latticing of such bands and longitudinal stripes, occasionally in the extinguishment of the yellow or orange stripes, and in one most striking, and indeed famous, form, by the amalgamation of black markings so as to form a complete uniform suffusion of the fore and hind wings with black, except a pure white band across them all at some little distance from their base. Of this unusually definite and well-marked variety a considerable number are said to have been reared by one collector near

Huddersfield, and specimens exist, all alike, in many of the larger collections. Another phase of variation, originating in Lancashire, and reared rather freely, has the round black spots of the margins of all the wings extended back between the nervures so as to form rows of handsome elongated black blotches; while a third shows a great extension over the wings of the orange colour of the stripes, or its intensifying so that a scorched or flame-coloured or purplish-brown tinge is given to all the wings. Some of these, reared by the late Mr. C. S. Gregson—who made a practice of rearing some thousands yearly in his garden at Liverpool, for the sake of varieties—are in the collection of Mr. Sydney Webb; also one in which there are broad bands of rich creamy yellow on the fore wings; and others in which, the basal portions of the wings being normal, their outer two-thirds are smoothly and uniformly black; or the wing from the base being so, the hind-marginal area alone is normal, or all the spots are connected by black nervures; also one which has a black spot at the base and another forming the discal spot, but is otherwise pure white except two clear and sharp rows of small black spots towards the margins; and one which is wholly creamy white, the creamy colouring being faintly deepened in the form of the usual spots. In Aberdeenshire a somewhat local form seems to have become permanent—creamy white with one large black central spot, and the spots of the outer area normal—and at Old Aberdeen Professor Traill has reared specimens of unusual and extreme blackness from larvæ fed upon *Ribes alpinum*, although the normal form only occurs with him on the ordinary species of *Ribes*. Others from the same district, in Mr. P. Bright's collection, are nearly black, but with intermediate spots of rich orange yellow. Even the London District seems to show a definite tendency in the very rare instances in which it furnishes an aberration among its multitudes of ordinary examples; one reared in Peckham by Mr. Percy Richards has the ground colour wholly dusky

orange-yellow, without a trace of white, but the spots normal; and two, obtained at Battersea, by Mr. Albert Hodges, have the full basal half of the fore wings orange-yellow. Two specimens, one in the cabinet of Mr. G. T. Porritt, and the other in that of Mr. S. J. Capper, are especially noticeable, because they have assumed one of the forms which so particularly mark large sections of our *Geometra*, having a regular scalloped basal blotch, a very broad and handsome black central band, broadest on the costa, and the usual marginal markings—singularly attractive looking specimens; another in the last named collection, and of quite equal beauty, has the margins of all the wings pure white, the usual rows of round black spots being totally absent; another is devoid of all the usual black spots, except that on the middle of the costa, and has only a few other small scattered spots on the white and yellow surface; while a fourth, belonging to the strain of uniformly black specimens, except the white band near the base, has also a few wedge-shaped white dashes beyond the middle of the hind wings. Notwithstanding the risk of being tedious, I cannot pass over the wonderful series of varieties reared by the Rev. Joseph Greene from larvæ fed almost entirely upon *Euonymus japonicus* at Bristol. Some have the fore wings deep black with yellow and white stripes, or white with broad yellow stripes, or all the wings are white with minute black spots; or the ground colour smoky-grey, or pale purplish-red; or the hind wings are grey and the fore wings white, with the usual range of markings; or unsymmetrically blotched and shaded; while some are of one-half the usual size; and one such has the fore wings almost lanceolate.

I have striven to give some idea of the excessive variation of this species, but do not claim to have by any means exhausted the subject. Dr. Mason's vast series fully vies with those already mentioned; and Mr. Porritt's, reared at Huddersfield, are very striking. Probably every collector who has devoted time and attention to the rearing of this

species has something well worthy of mention. Possibly it may be desirable to point out that in this species, as in *Arctia caju*, the widest range of variation seems to accompany the absence of definite transverse lines and other patterns as usually found in the groups to which they belong. One more extraordinary specimen must be mentioned; it has a large piece of additional wing placed abnormally in an irregular lobe upon the costa; it was reared near London by the Rev. J. S. St. John.

On the wing at the end of June and in July and August; in very rare instances a second generation has been reared in the winter.

LARVA stout, cylindrical, body furnished with a few short black hairs; head and second segment much smaller than those following; head black; body yellowish-white; dorsal line composed of a series of roughly-shaped black squares alternating with pairs of black dots, a square and two dots on every segment; subdorsal line indicated by a row of black dots; spiracular line broad, dull earth-red, placed between two rows of irregular black spots; on the under-surface are two parallel black lines running from the legs to the first pair of prolegs, the latter being tinged beneath with red and tipped with black; legs also black. In repose sits in the position of the Greek letter  $\Omega$ . (C. Fenn.) A variety of this larva nearly suffused with black has been observed in Northumberland and elsewhere.

August till May or June on black currant, gooseberry, red currant, and blackthorn; feeding principally at night; also occasionally on *Ribes alpinum*; in city gardens and elsewhere, on *Euonymus japonicus*; in certain wild localities, as on Ailsa Craig in the estuary of the Clyde, and in Cornwall, on *Cotyledon umbilicus*; in some southern localities on *Sedum telephium*, and even, if other food fails, upon ivy. On the Continent it is said to feed freely upon bird-cherry. Its vagaries of taste do not usually appear to result from

scarcity of food, as, for instance, in Cornwall, where it has been found quite to neglect currant and gooseberry, while feeding in abundance on some of the other plants just mentioned. In Herts the same daintiness has been noticed in certain years with regard to the *Euonymus*. I am further informed by Mr. A. F. Griffiths that in the Hebrides the larvæ of this species feed, in multitudes, upon *heather* (*Calluna vulgaris*), and that the moths, of ordinary colour and markings, may be seen sitting, side by side, in hundreds on the rocks close above.

Hybernation takes place while it is quite young, sometimes in a rolled or curled currant leaf, often in any interstice in a wall or paling, or under almost any shelter where the larva may be kept moderately dry; although quite in repose, it does not become torpid, but if disturbed will drop and hang by a thread, returning to its retreat when the danger has passed. If the summer is hot, some will occasionally continue to feed, instead of retiring for hybernation, and may be found full grown at the end of autumn. In a recent season—1899—for instance, Mr. N. Heywood of Manchester found pupæ upon his currant trees at the end of November, from which he reared moths, which he sent to me with a still living pupa. A similar circumstance was noticed in 1879 by Mr. J. W. Douglas and others. But from all the observations made, it seems certain that, except when brought indoors and reared there in the winter, none of these abnormally fed up larvæ produce the perfect insects; all in that, or the pupa state, being killed by the winter frosts or by excessive moisture. Possibly this fatal tendency may help in some degree to check the vast increase of this species which, with the help of *Halia warraria*, and the saw-fly *Nematus grossularia*, at times threatens the destruction of the crops of currants and gooseberries in our gardens. Forty years ago a close observer wrote: “We have this year a perfect plague of the larvæ of this common insect, which has appeared in immense numbers in all the gardens. I



have seldom noticed it to attack anything but the red and white currant bushes; but this year scarcely anything has escaped its ravages; red, white, and black currants, gooseberries, apple-trees, hollyhocks, cabbages; indeed, there is scarcely a vegetable or flower which has not more or less of the pest upon it. In our own garden the larvæ came out very early, feeding upon the unopen buds of the gooseberry, which they devoured so effectually that many of the smaller bushes never showed a leaf, and latterly many of the larger ones have been completely cleared of foliage, fruit, and young shoots."

PUPA plump and short, thickest in the middle, the ends of the wing-covers very much filled out; abdominal segments but little tapering; anal segment full and rounded; cremaster very curious,—a short, broad, flattened projection, deep black, furnished with two thick, middle, black, projecting hoops which curl outwards; one similar on each side of them, also short and thick and curling outwards, and a short pointed spike at each side of the base; limb-covers compressed, hardly sculptured, but with the covers of the head and eyes smooth and brilliantly shining; wing-covers equally so, and very smooth; antenna-cases thick and distinctly sculptured in cross-channels; anterior portions of the dorsal and abdominal segments shining, but dotted with minute pits; the hinder area occupied by a broad, swollen, smooth yellow band, except in the terminal segment where the band is equally smooth, but of the ground colour—dark shining bistre-brown. In a very slight cocoon of a few threads which do not in the least conceal it, among the leaves or on the branches of its food plant, or on any convenient fence, wall, tree trunk, or piece of woodwork close by; usually under a ledge, piece of bark, or covering of some kind

The moth is slow and heavy upon the wing, with a flapping lazy motion, and may often be caught with ease in the hand. During the day it sits conspicuously on any fence, garden



wall, or shed, on the leaves of its food or other shrubs and plants, its fore wings covering the hind and forming a broad triangle, and in no way concealed. Moreover, it is not restless or timid, but regards all intruders with entire indifference, allowing itself to be picked up from its resting-place, and at once feigning death, also exuding small drops of a yellowish fluid from its thorax, which are supposed to be of a nauseous character, and which certainly stain the hands. After a short time, if left alone, it arouses itself and flutters lazily away, to settle again at a short distance. Its time of natural flight is at dusk, when it is equally lazy and indifferent to capture, fluttering slowly about, and if caught, again feigning death, always showing a marked contrast in habits to the activity and alertness usual in the large family to which it belongs. Plentiful everywhere in gardens and lanes, also common in and around woods, and abundant in fens, throughout England, Wales, and Ireland; in Scotland more restricted to gardens, usually abundant, but sometimes local, and extending to the Hebrides in the west, and to Moray in the east. Apparently it is somewhat fluctuating in this country, since Sir Thomas Moncrieffe wrote in his "Lepidoptera of Moncrieffe Hill": "I am thankful to say that I have not seen this insect at Moncrieffe for many years, although I remember seeing it in the garden in plenty when I was a boy. It has, however, occurred in some of the cottage gardens since that time."

Abroad it has a wide range through Central Europe, the temperate portions of Northern Europe, Northern Italy, Dalmatia, Southern and Eastern Turkey, Southern Russia, Armenia, Siberia, Tartary, Central China, and Japan.

2. **A. ulmata**, *Fab.*; **sylvata**, *Staud. Cat.*—Expanse  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inch. Wings glossy white, banded with cloudy grey spots (black on the underside); at the base of the fore wings, and also at the anal angle of both fore and hind wings, is a large round brown-black blotch or spot, clouded with orange, and embellished with metallic-blue.

Antennæ of the male simple, but so strongly ciliated as to appear bristly under a lens, purplish-brown; palpi very minute, brown; tongue moderately long; eyes pale leaden-black; head black; thorax dark brown, barred with black, and on the collar and shoulder-lappets barred with white; abdomen smooth, orange-yellow, with a row of brown spots down the dorsal ridge, and several rows of smaller black spots, placed alternately, down the sides; lateral tufts orange-yellow; anal tuft black, tipped with yellow. Fore wings rather ovate; costa strongly arched; apex rounded; hind margin gently curved and rather oblique; dorsal margin nearly straight, ciliated; colour white; at the base is a dark tawny-brown blotch, containing a more fulvous cloud and some glistening blue-white scattered scales; this occupies the whole base, and its well-defined outer edge may possibly represent the usual first line; the second line is more definitely indicated by an oblique, and rather curved, row of faint grey, or smoky, spots which arises from a large rounded blotch of rich brown clouded with tawny, and dusted with glistening blue scales, lying upon the dorsal margin just before the anal angle; opposite to it is a smaller brown cloudy spot on the costa having a similar dot at its apex; discal spot a brownish ring, or else a white spot, in either case lying in a rounded smoky-grey cloud, immediately before which two or three smaller similar spots suggest a central shade; costa edged with smoky-brown; hind margin with cloudy grey spots, often supplemented by a far larger one in the middle; cilia partially white, but much coloured by the marginal spots. Hind wings ample, elongated, rounded behind; central spot small, rounded, smoky-grey, sometimes supplemented by a similar spot just above; beyond it is a row of four or five such spots forming a curved transverse series which ends on the dorsal margin in a large round red-brown blotch dusted with glistening blue scales; cilia white, often with one or more smoky-grey spots. Female often slightly larger, but extremely similar.

Underside of all the wings white ; all the spots and blotches of the upper side repeated and rather enlarged in pale smoky-grey, or pale purplish-grey, and all equally distinct. Body orange-yellow, spotted with black ; legs purplish-grey.

Variable in the extent of the smoky-grey cloudy spots, which often are more or less massed together, and augmented in size, that around the discal spot in particular being frequently prolonged, sometimes to the base of the wing, and also joined to the spots of the second line. Sometimes these clouds are extended so that the white ground colour is wholly superseded by a semi-transparent dull lead-colour. This last form seems to be most frequent in Yorkshire, where also is found a very beautiful variation in the opposite direction, the smoky-grey clouds and spots being in it almost absent, or only in part indicated round the discal spot, so that these are nearly white, with the exception of the tawny-brown blotches. In some of our larger collections are specimens in which these blotches also are more obscure, except the one at the base of the fore wings, from this ranging through every gradation to the normal colouring, and thence to the form in which the whole of the wings have become suffused with semi-transparent silky-grey, or lead colour. In Mr. Sydney Webb's collection is a strange specimen, having one leaden-grey fore wing, the rest of the insect being of normal colouring. Another in Mr. S. J. Capper's collection, has the *cilia* leaden-grey, the remaining portions of the wings being hardly darker than the typical form ; and another is wholly smooth smoky-black. In the opposite direction, Mr. J. E. Robson has taken, in Castle Eden Dene, Durham, a most beautiful *white* specimen, having the usual round tawny-brown blotches, but quite devoid of the smoky-grey clouds ; and Mr. Capper has one in which the grey clouds of the second line are replaced by short brown streaks, while a similar series crosses the hind wings. An equally white one in Mr. Webb's collection has a neat greyish ring around the discal

spot; another, very different, but almost equally devoid of darker clouding has the whole surface of all the wings of a glossy, silky lead-colour, exactly as though "blacklead"; again another, in which the usual markings are present, has the outer half of each wing shaded with smoky-grey in cloudy stripes which run from inwards; and a fourth possesses a complete cloudy-grey central band crossing the hind as well as the fore wings. One of the most striking and beautiful aberrations which has come under my notice is one having the costal region broadly *yellow*, and all the ordinary markings richly dark. It was taken near Tamworth by the late Mr. W. G. Blatch, and is, I believe, still in his collection. One equally remarkable was taken last year in Yorkshire by Mr. D. H. Crabtree; its markings are all suffused, drawn together, and crowded into the inner area of all the wings, the outer third of each being left pure white.

On the wing at the end of May and in June. There is a record of a single specimen of a second generation taken in October.

LARVA stout, cylindrical; skin smooth; head round, black, very highly polished; on the anal flap and anal prolegs are shining black plates; general colour of the back lemon-yellow, shaded with white at the divisions of the segments; dorsal line black, broad and distinct; there are three conspicuous black lateral lines, the spaces between them being white, the uppermost of these lines is sometimes much interrupted; spiracles black; below them is a broad yellow stripe in which the lateral raised spots appear as numerous black dots; undersurface black with three yellow stripes, the central one broad and whitish at the divisions, but these three stripes are occasionally white; legs shining black. (C. Fenn.)

August to October on wych-elm (*Ulmus montana*), but if this food fails it will eat beech and hazel. Abroad it is said to feed upon *Prunus padus*. The Rev. Joseph Greene says,

“like the perfect insect, it is a heavy, sluggish creature, and does not seem to thrive in confinement. It appears to have the power of producing an almost unlimited quantity of silk. Whenever I have met with this insect it has been in boundless profusion. Give the tree a tap with a stick, and down comes a whole shower of larvæ.” Mr. W. Holland has pointed out that in the beech woods on the northern edge of the upper Thames valley are occasional straggling wych-elms; and that upon these the larva of this species is most abundant, at times defoliating them, and compelling the larva to eat the leaves of neighbouring beeches and other trees, also thus producing the impression that the natural food of this species is beech.

PUPA short and stumpy; head and eye-covers rather projecting, black; wing-covers moderately thickened, shining pitchy brown; limb and antenna-cases of the same colour, the latter showing the joints distinctly; dorsal and abdominal segments blackish-brown, dull from abundant pitting, except the hinder-edge of each segment, which is smooth, and of a lighter brown; cremaster conical, but extremely short, terminated by a shining black spike, minutely bristled and hooked. In a slight cocoon in the ground or upon the surface among rubbish.

The winter is passed in this condition.

This moth has a curious habit of sitting during the day in the most conspicuous manner possible upon grass or low-growing plants, under the trees at the edges of woods, or in open rides and paths, sitting flat upon the upper side of the leaves, so that it can be gathered in almost any number by hand. One curious form of protection it possesses in the fact that, as it so sits on the leaves of dog's mercury, sanicle, or other woodland plants, it bears the most remarkable resemblance to the splashes of white excrement, which fall upon the same plants from young wood-pigeons in the trees overhead. At dusk it flies lazily about the trees. Apparently

always confined to woods, and local, yet usually abundant where it occurs. This, however, is not universal, its occurrence in Surrey, Middlesex, and the South Coast counties seems always to be casual only, and in single specimens; but in the beech-woods of Oxfordshire and Buckinghamshire it is found in abundance about the scattered wych-elsms; it seems to occur locally in North Devon, and in abundance in restricted spots in Somerset, Gloucestershire, and all the other western counties to Cumberland; also throughout the Midland and Northern Counties to Northumberland, in many of them plentifully in every wood; and in far smaller numbers in the Eastern Counties. Of its range in Wales—which must surely be considerable—I find no record, except that I took it myself rarely, in Pembrokeshire. In Scotland it seems to be restricted to the extreme South, the districts of the Tweed and Solway only; Mr. G. Guthrie tells me that in certain years it occurs plentifully near Hawick. The record for Ireland is most singular—one specimen taken in Carlow, in the collection of the Rev. John Bristowe, and one from Killarney, in that of Mr. C. W. Watts. Abroad it has a very extensive range, especially in hill and mountain districts, through Central Europe, Northern Italy, Sweden, Livonia, and Southern Russia; Armenia, Tartary, Northern India, Assam, Penang, Corea, Japan, and China.

[**A. pantaria**, L.—A species very closely allied to the whiter varieties of *A. ulmata*, but without any trace of the grey clouding; the basal blotch and costal and dorsal brown spots smaller and much more yellow; the head and thorax also yellow. An inhabitant of Southern and Western Europe, its larva feeding on ash. Of this species, Mr. Stainton says in his “Manual,” “Said to have occurred at Oakhampton Park, Somerset,” and Mr. Stephens, in his *Illustrations*, “One of the rarest of our *Geometridæ*; it has occurred in the neighbourhood of Oakhampton Park, Somersetshire; and, according to Mr. Haworth, on the authority of the late



Mr. Francillon, in Devonshire; I possess a fine specimen from the former locality." Mr. Haworth's description of the insect is hardly definite enough to certainly indicate this species; but Stephens's description, and that of Professor Westwood, with his figure, certainly refer to it; moreover, Haworth's specimen exists in the cabinet of Mr. Sydney Webb at Dover. This is the only reputed British example of the present existence of which I have any knowledge. Its occurrence in this isolated manner is so contrary to the known habits of the species, that it seems doubtful to me whether a confusion has not arisen between some foreign specimen and one of the whitish form of *A. ulmata*. The evidence existing is, at any rate, hardly sufficient to warrant the inclusion of this species in the Fauna of the British Isles.]

#### Genus 42. **LIGDIA.**

Antennæ simple; palpi minute; head smooth; thorax also smooth and small; abdomen short, moderately slender, smooth; fore wings ovate, glistening, with the lines sharply defined, and vein 5 originating above the middle of the cross-bar; hind wings broad, rounded, crenulated behind.

We have only one species.

1. **L. adustata**, *Schiff.*—Expanse 1 inch. Fore wings ovate, white or creamy-white, with a basal blotch and broad band beyond the middle of orange-brown, or black, set off with glistening blue clouds; hind wings white, faintly rippled with grey.

Antennæ of the male simple, ciliated, pale brown; palpi minute, pointed, dark-brown; tongue moderately developed; head and thorax hardly rough, purplish-brown, the latter bluntly tufted behind; abdomen slender, white, clouded along the dorsal region with pale purplish-brown; tufts small, white. Fore wings rather ovate; costa much arched;

apex rounded; hind margin gently curved; dorsal margin nearly straight, ciliated; colour creamy yellowish-white; first line somewhat duplicated, black, forming the outer edge of a rich brown blotch at the base, dusted with silvery-blue; second line cloudy reddish-brown, spotted with black, erect from the dorsal margin, curved and undulating gently outwards then curving back to the costa; this line is the inner edge of a very beautiful broad transverse stripe, glistening bluish-grey, clouded through the middle with black, margined outwardly by rounded projections, throwing out small similar cloudy spots above the middle, and beneath these, small fulvous clouds, thus almost filling the hind marginal space; between the two lines the usual central shade is represented by a fine line of small brown dots, arising from a rather larger one on the costa; extreme hind margin dotted with black; cilia creamy-white, a little clouded with grey-black. Hind wings ample, rounded or faintly squared, and slightly crenulated behind, having a small hollow in the margin just above the middle; creamy-white, faintly dappled with yellow-brown, and having three small brown spots upon the dorsal margin, each of which originates a faint dappled or crenulated smoky-brown transverse line or shade, the outermost distinctly scalloped; beyond it is a fainter shady line close to the hind margin, central spot a small brown dot; cilia creamy-white. Female a little stouter in body, the faint transverse lines of the hind wings sometimes more distinct, or even forming a broad cloudy band, otherwise similar.

Undersides of all the wings yellowish-white; the fore wings shading more toward yellow along the costa, and dusted in the middle area with pale purplish-brown; the markings of the upper side reproduced in the same pale tint; the central spot of the hind wings black, and the shaded lines deepened into transverse bands. Body and legs brownish-white; the tarsi barred with purplish-brown.

There is a slight difference in the ground colour of the

upper side between the first and second broods, the former being the whiter, the latter more creamy ; also, in the second brood especially, there is often in the markings of the fore wings a tendency to tawny shades and clouding, while the shading of the hind wings varies as already stated.

On the wing in May and the beginning of June, but sometimes, in very forward seasons, at the end of April ; and as a more or less partial second generation at the end of July, and in August, or even September.

LARVA smooth, short, stout and cylindrical ; head small and rounded, whitish-ochreous edged with dark brown ; mouth green ; general colour dark emerald-green ; three dark red dorsal spots, edged on each side with white, one each situated on the fifth, sixth, and seventh segments ; two large yellowish-red lateral spots surround the spiracles on the sixth and seventh segments, and two smaller ones those on the eleventh and twelfth, between the two former is a large dark brown blotch ; spiracles black faintly shaded with reddish-ochreous ; legs and prolegs brownish-pink ; on the ventral surface is a broad yellowish stripe. (C. Fenn.)

Some larvæ, figured and described by Mr. Buckler, had on the anterior part of each of the sixth, seventh, eighth, eleventh, and twelfth segments a bright red elongate spot, bordered on either side by a black, and then a white line ; they had also thread-like subdorsal and spiracular white lines.

Another variety, described by the late Rev. J. Hellins, has the ground colour above grey-brown ; a broad ochreous-yellow dorsal stripe, widest in the middle of each segment, and contracted at the segmental divisions ; very thin subdorsal and spiracular white lines ; on the front of each of segments four, five, six, and seven are two dorsal white spots, and on each segment ten black dots ; undersurface and sides of the first five segments of the same colour as the back, but for the remainder ochreous-yellow ; the lateral blotches on seg-

ments five, six, and seven dark brown, followed by smaller spots on the hinder segments; the head also has a dark brown spot on each lobe.

June and the beginning of July, and, as a second generation, in August, September, and even October; on spindle (*Euonymus europæus*), feeding at night, but remaining during the day upon its food-plant, to the twigs of which it bears a close resemblance; if disturbed, it drops and feigns death.

PUPA thickest in the middle, the hinder portions of the wing-covers being thickened and swollen, almost bulbous, certainly quite corpulent; eye-covers also very prominent, and mouth organs filled out, leaving a hollow just below; antenna-cases so sculptured as to appear beaded; abdominal segments rapidly tapering, very faintly punctured over a broad surface, the smooth hind band of each segment narrow; cremaster a conical spike, tipped with several minute hooked bristles; eye-covers black; wing-covers smooth and shining, pitchy black; remaining portions shining dark red-brown. In a slight cocoon of fine silk, in the earth.

The winter is passed in this condition.

The moth sits during the day among the leaves of its food-plant, and may easily be disturbed, when it flies quickly to a similar hiding-place; its natural flight is at dusk and in the night, when it will come to a strong light. Common in lanes where spindle grows in the hedges, also in the margins of woods, and probably anywhere about its food-plant, but not found very far away from it. In this manner fairly common in all the Southern and South-Western Counties to Worcestershire, and the Eastern to Norfolk; much less frequent in the Midlands, but recorded very locally in Leicestershire and Warwickshire, and rarely in Derbyshire; also in Yorkshire occasionally, in Lancashire rarely, and in Westmoreland. In Wales the only locality in which I find it recorded is Dolgelly; there is one doubtful record in the extreme

South-east of Scotland, and, strange to say, one, which appears to be confirmed, in the Hebrides! In Ireland it seems to be most frequent in the West, and has been taken even in Garinish Island, off the coast of Kerry, also elsewhere in that county, and in Galway, Tipperary, Wicklow, the neighbourhood of Dublin, and in the King's County. Abroad it has a wide range through Central Europe and a large portion of Southern Europe, Sweden, Livonia, Bithynia, Armenia, portions of Asia Minor, and even Japan.

#### Genus 43. **LOMASPILIS.**

Antennæ simple, palpi minute, head, thorax, and abdomen very smooth and slender, the latter short; fore wings rather elongated, narrowly ovate, with very oblique hind margin; hind wings broadly rounded, squared at the anal angle; both clothed with minute shining scales.

We have but one species.

1. **L. marginata**, *L.*—Expanse  $\frac{3}{4}$  to 1 inch. All the wings white, broadly bordered with irregular interrupted blotches, or bands, of dark slate colour or purplish-black, often having also a central band of similar spots.

Antennæ of the male simple, minutely ciliated, purple-black; palpi very minute, purple-brown; tongue well developed; eyes jet black; face smooth, purple-black; head dusky-brown; thorax smooth, purple-black, glossy and iridescent; abdomen similar; lateral tufts of moderate size; anal tuft very small. Fore wings rather narrow; costa well arched; apex somewhat bluntly rounded; hind margin oblique but not much curved; dorsal margin rather straight and strongly ciliated, very silky-white; a large slate-black basal blotch extends as a stripe to nearly the middle of the costa, but below is much cut off and angulated; along the middle of the costa and for some distance beyond is another blotch or stripe of the same colour, attenuated below, but often extending over one-half the width of the wing,

and suggesting a central band ; beyond this is a broad band of the same colour occupying the whole of the apex, hind margin, and anal angle of the wing, its inner edge sinuous and deeply excavated in the middle ; cilia glossy dark slate colour. Hind wings rather long and ample, hind margin rounded, but a little sinuous ; anal angle rather squared ; white and very silky ; just before the middle is usually a transverse row, or broken band, of slate-black spots or blotches ; two larger spots of the same colour occupy the apical region, and one still larger the anal angle, while between them is often a dot or two ; or very often some or all are joined into a marginal band ; in them there are frequently white dots ; cilia slate-black, but against any white portion dashed with white. Female very similar.

Undersides of all the wings accurately as upon the upper. Body and legs slate-grey powdered with white.

Exceedingly variable, in the directions already to some extent indicated—in the breadth and degree in which the marginal bands are complete, or broken into blotches, particularly in the hind wings ; also in the absence or presence of a central band of spots of the same colour, and extending in almost any degree in dots, spots, or a stripe, to the hind wings. Occasionally this is filled in as an unbroken, but most irregular, central stripe through all the wings. In specimens in which the white area is large the margin of the fore wings towards the apex is often dotted with white, or even divided by a white line, and along with this it sometimes occurs that the dark margin of the hind wings is reduced to extreme narrowness. Much more rarely specimens occur wholly of a pure white, or even creamy-white, except one or two dark blotches on the costal margin of the fore wings ; one such is in the collection of the late Mr. H. Doubleday at Bethnal Green Museum ; another has been taken near Lynn by Mr. E. A. Atmore. One in Mr. S. Webb's collection is similar, another has in addition a spot at the anal angle, but all the spots are very faint ; and one, having



scarcely any dark bordering, has the central band complete and sharply marked, and looks like a totally different species. A curious form has been found in the North of England by Messrs. Robson and Gardner, in which, while the markings are dark, the *cilia* are white.

On the wing from the end of May till August, apparently in one generation, emerging at long intervals. This extension seems to occur more particularly in damp situations.

LARVA slender, rather roughened but without humps; head rounded, pale green, a broad ill-defined chocolate-brown stripe runs down each lobe from the top, mouth spotted with the same colour; body yellowish-green; dorsal stripe double, dark green, but concluding with a red-brown patch at the anal extremity; subdorsal lines also double, dark green; spiracles minutely dotted with black; spiracular region puckered, and rather inflated or rigid, clouded with whitish-green; undersurface and legs clearer green. Rather active, and remarkably flexible, having a sort of fondness for reaching back and stepping over its own anal segment. (From larvæ kindly furnished by Mr. W. H. Harwood.)

June till August or September, on willow, osier and aspen, sometimes on poplar and hazel. It hides during the day under a leaf of its food-plant, with which its colour harmonises very closely.

PUPA short and stumpy, the abdominal rings particularly contracted; the head not prominent and limb-cases closely appressed; antenna-covers more prominent, and very neatly beaded; wing-covers showing obscurely the wing-nervures, smooth and not very glossy; dorsal and abdominal regions dull but hardly perceptibly pitted, segments ridged behind; anal segment thickened, provided with a very small conical cremaster on which is a short spike; colour dark red-brown; segments rather brighter red. In a soft cocoon of silk and earth; underground.

The winter is passed in this condition.

The moth sits during the day usually underneath a leaf of its food-plant, pressed closely and flatly to its surface, and flutters feebly out on being disturbed, to hide itself in a similar spot, or to settle down on any neighbouring plant. Rather a lazy species at all hours. At dusk it flies about the same bushes, and may be attracted by a strong light, but at no time exhibits any great vigour. Common in all woods in which undergrowth is plentiful, but more especially in those containing open damp ground with plenty of sallow bushes; also very common in the fens. In such suitable spots abundant throughout England, Wales, and Ireland, and common in the South and East of Scotland; extending so far north as to Moray and West Ross. Abroad it is common through Central Europe, the more temperate regions of Northern Europe, Central and Northern Italy, the Ural Mountain district, Eastern Siberia, Tartary, Central China, and Japan; in these latter chiefly in its darker forms.

#### Family 2. **GEOMETRIDÆ.**

Antennæ pectinated or simple; palpi small, tongue moderately developed; thorax rounded or narrow, covered with soft downy scales; abdomen rather short, moderately slender, sometimes slightly crested; fore wings rather trigonate, ample; hind wings moderately broad and having vein 5 fully developed, and placed much nearer to vein 6 than to vein 4.

LARVÆ somewhat stiff, often stout and rather hunched, frequently having a pair of points on the second and anal segments.

PUPÆ usually green or grey, in a slight silken cocoon.

#### Genus 1. **PSEUDOTERPNA.**

Antennæ of the male shortly pectinated; palpi curved upwards; head smooth, with a transverse division across the face; thorax rounded, smooth in the middle, shoulder-lappets

raised; abdomen rather slender, tapering, minutely crested on three segments; fore wings trigonate, with a short discal cell; hind wings rather squared.

We have only one species.

1. **P. cytisaria**, *Schiff.*; **pruinata**, *Staud. Cat.*—Expanse  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch. Body moderately slender, abdomen tapering; fore wings triangular, bluish-green, with two faintly bluer or greyer jagged transverse lines, and a cloudy white subterminal line; hind wings paler.

Antennæ of the male pectinated to near the tip with short solid ciliated teeth, apex simple, teeth brown, shaft white; palpi short, black-brown above, white beneath; tongue long; face deep black, but sharply divided off beneath the antennæ, the upper part of the head being white; thorax rounded, fluffy with raised scales on the shoulder-lappets, bluish-green; abdomen tapering, greenish-white, the first three segments decorated with loose dorsal crests of the same colour—which, however, are often absent or laid down—lateral tufts large and conspicuous, white except the hinder and the anal tuft, which are pale ochreous. Fore wings trigonate; costa gently arched; apex bluntly angulated; hind margin gently and evenly rounded; dorsal margin straight, strongly ciliated; first and second lines both rather near to the middle of the wing, often very obscure, the first erect, a little curved, toothed on the nervures, clouded and rather thick, grey-green; the second similar in colour and thickness, very little oblique, much toothed on the outer side, two points in the middle more especially projecting; discal spot a slender perpendicular green streak; half-way between the second line and the hind margin is a faint cloudy white indication of a rather direct subterminal line; cilia pale green, tipped with white. Hind wings elongated and somewhat squared, the hind margin but slightly curved and the anal angle rectangular; pale green, shading off nearly to white at the base and upper portion of the costal region; in the middle of the wing is an

extremely faint transverse grey-green line, and beyond it an obscurely white transverse stripe; cilia pale green, tipped with white. Female decidedly stouter, but with hardly a trace of the dorsal tufts on the abdomen; antennæ simple; the transverse lines of the fore and hind wings usually more distinct; otherwise similar.

Undersides of all the wings dull pale bluish-green, shaded to beyond the middle with a faint tinge of brown, rather more so along the costa of the fore wings; discal spot and second line of these wings and the central line of the hind just visible. Body and legs dull pale green.

Rather variable in the depth of colour, more so in the distinctness of markings, in some female specimens even the white subterminal line becoming conspicuous; but the fugitive nature of the colour in this species renders it difficult to distinguish between variation and fading. Freshly emerged specimens are sometimes of a very bright, in other instances of a curiously *blue-green*. Fading seems to be caused very rapidly, during life, by exposure either to damp or sunshine, and captured specimens are rarely well coloured except when fresh from the pupa. When preserved it must be kept extremely dry, but in spite of all precautions the green colour usually begins soon to fade out in the base of the wings, and the discoloration soon spreads to the thorax, more slowly to the remainder of the wings, which gradually become yellowish-white or even very pale buff. The series in a collection therefore requires renewal, if possible, every few years.

On the wing in June and July, but in rare instances single individuals of a second generation may be found at the end of August or beginning of September.

LARVA stout; attenuated in front; anal segment prolonged into two short points; head squared, deeply bifid, dark green; second segment also divided, having four vertical dark green raised points; general colour dark green; dorsal line incon-

spicuously darker; subdorsal lines whitish; spiracular lines pink; anal points margined with white; undersurface provided with three distinct white lines, approximating at the base of the third pair of legs, to which point the spiracular line emits a branch. (C. Fenn.) But often the points on the head and second segment are pink, the spiracular line has become a broad pale pink stripe, and the anal points are of the same colour.

August till June, on broom, furze, and petty-whin (*Genista anglica*), feeding at night. In the daytime it remains upon its food-plant, its legs folded close to, and almost concealed under, the anterior segments, the points of the latter, with its stiff attitude, giving it a singular resemblance to a small twig. It hibernates, while quite small, upon the stem of its food, in a perfectly rigid posture, half erect, and showing the most perfect indifference to weather, even the severest frost. In confinement it is easily induced to eat the leaves of Laburnum.

PUPA smooth, slightly elongated; hooked at the anal extremity; very pale green, shaded with ochreous and pink; the whole surface covered distinctly with small black dots; antenna-cases marked with converging black dots; dorsal line darker green; anal extremity reddish. In a slight cocoon formed of a few silken threads between the drawn-together twigs and leaves of its food-plant, between which it is quite visible, and from among which it is easily dislodged. (C. Fenn.)

The moth sits during the day among the twigs of furze and broom, or sometimes conspicuously upon the bushes, when it may readily be boxed. When beaten out it flies vigorously to a similar hiding-place at no great distance. Its natural flight is at dusk and in the night. Common upon heaths, moors, and commons, or even open woodlands, where its food-plants grow, throughout the Southern, Eastern, and Western Counties of England; very scarce in the Midlands,

but has been once recorded in Derbyshire, and rarely in Warwickshire and Staffordshire ; found also locally in Cheshire, Lancashire, Yorkshire, and Cumberland, and seems recently to have spread along railway banks into Durham. Probably to be found throughout Wales, since it is recorded in the northern portion, and at Swansea, and I found it not uncommonly in Pembrokeshire. In Ireland it is generally distributed and common, but in Scotland it seems to be limited to the south, not extending beyond Perthshire.

Abroad it is common in Central and South-Eastern Europe, Spain, Italy, and Bithynia ; moreover, a large greenish-white form, called var. *simplex*, from Western China, is believed to belong to this species ; if so, it has most probably a considerable Asiatic distribution.

## Genus 2. GEOMETRA.

Antennæ of the male shortly and stoutly pectinated almost to the tip ; head downy ; thorax covered with very soft raised hair-scales ; abdomen long, moderately slender, without dorsal tufts, smooth ; fore wings broad and bluntly pointed, faintly crenulated ; hind wings large, rather elongated, crenulated.

We have but one species.

1. *G. papilionaria*, L.—Expanse 2 to  $2\frac{1}{2}$  inches. Antennæ white, thorax rather thick, green ; fore and hind wings broad and ample, faintly crenulated behind, rich full green, each with one or more rippled white transverse lines ; abdomen silky-white.

Antennæ of the male pectinated with solid curved ciliated teeth of a pale brown colour, almost to the apex, shaft white ; palpi small, but the tips prolonged and a little upturned, green ; tongue well developed ; face, head, and collar rich green ; thorax rather broad, rough with long soft loose scales, rather paler green ; abdomen not very slender, smooth, silky-white with the faintest possible tinge of bluish-green ;



lateral and anal tufts very small. Fore wings broad and ample; costa fully arched; apex very bluntly angulated; hind margin rather oblique, gently curved, and faintly undulating or crenulated; dorsal margin rather full and strongly ciliated; colour rich green; first line very obscure, erect, but often not reaching the costa, white, shaded off inwardly, but outwardly edged with rather darker green; second line not very distinct, disposed in crescents between nervures throughout, white, inwardly edged with darker green; midway between it and the hind margin is a faint series of cloudy white spots, forming an imperfect or obscure subterminal line; discal spot an erect dark green crescent, not very distinct; cilia green, rather short. Hind wings large, rounded and crenulated behind, rather squared at the anal angle, of the same green colour as the fore wings; central spot an obscure dark green streak; in the middle of the wing a transverse curved row of white crescents, and beyond this is a more indistinct row of white cloudy spots; cilia green. Female rather larger and stouter, with simple antennæ, otherwise closely similar.

Underside of the fore wings rather deeper fuller green than the upper, crossed in the middle by a still deeper green stripe; dorsal margin paler. Hind wings rather paler, and faintly showing the transverse rippled line, and row of spots of the upper side, in a paler shade of green. Body whiter green; legs brighter green, but the tarsi brownish-white.

Usually only variable in the distinctness of the transverse white lines and crescents, but Mr. B. A. Bower has a specimen in which the hind wings are clear smooth *white*, except a large green blotch near the base. In 1866 and 1867 Sir J. T. D. Llewellyn captured in the neighbourhood of Neath, South Wales, three specimens of a rich cream colour; whether they had emerged from pupa of this colour, or had become faded while alive, there was, apparently, no evidence to show. Usually the colour is fairly well maintained during life, but

preserved specimens fade in time, and if in any way damped are liable to do so rapidly, to a dull yellow.

On the wing at the end of June and in July.

LARVA thick, very rugose; head rounded into prominent lobes; on the front of the second segment is a broad raised dorsal ridge; on the front of the third another, still broader, produced into an angulated hump; upon the seventh, eighth, and ninth segments are pairs of pointed dorsal tubercles, or humps, those on the seventh rather pressed together; very small rugose excrescences on the last three segments; the whole skin, in fact, varied with ridges and hollows, and having a distinct projecting ridge or fold down each side, beneath the spiracles, and extending to the anal prolegs; these last are very large and powerful, clasping completely round a twig. Head pinkish-white, the lobes tinged with brown or pinkish-brown; body soft dull velvety green, or bright green, or yellow-green, with all the little ridges paler, the lateral ridge decidedly so; the tips of the dorsal tubercles bright light brown or pinkish-brown, and an elongated dorsal blotch on each of the last three segments brighter brown, very broad on the last; undersurface yellow-green; legs and ventral prolegs pale purplish-green; anal prolegs pale pink.

The infant larva is black, but soon becomes tinged with orange, and with grey or brown; before hibernating it has assumed almost the exact appearance of a tiny brown twig, and appears much shrivelled; in early spring, while the trees are still bare, it becomes reddish-brown or purplish-brown, like the buds and twigs which it then gnaws for food; as the buds open and allow the young leaves to appear it begins to become green in front, the hinder part remaining brown, like the scales at the back of the opening bud; as this further opens the larva becomes greener. If upon birch, which opens early, this change takes place in early spring, the green is light and bright and the hinder brown portion brightens; but if the larva is upon alder, the

head and whole dorsal surface remain at this time of a dull purple-brown, the undersurface changing to green mixed with purple-brown. Thus it suits itself to either food-plant, so that its deceptive resemblances are wonderfully perfect.

August till May or June, on birch and alder; occasionally also on hazel, beech, and broom; usually resting upon the apical portion of a twig, where its extraordinary series of resemblances to twigs, buds, and wrinkled opening leaves, or when half grown to a catkin, are of the most service. It is best collected by searching the food-plant, since its hold to the twig, by its powerful anal prolegs, is so tenacious that it can scarcely be beaten off without serious risk of injury.

PUPA delicate and thin-skinned; head portion rather sharpened; limb-covers very closely compacted, indicated by thin lines; antenna-cases broadly sculptured, or rather wrinkled, into transverse furrows; wing-covers and back of the head-piece very rugose and minutely furrowed all over; segments minutely roughened, hardly pitted, and even the hind bands of the segments dull; anal segments rounded above, rather flattened below, with the anal structure conspicuous; cremaster conical, furnished with stiff projecting hooked bristles which cling closely together and hold firmly to the silken cocoon, colour pale green, the wing-covers tinged with brown, and the dorsal region spotted with reddish-ochreous. In a slight cocoon among fallen leaves, or moss, upon the ground.

The moth hides during the day in a birch or alder tree, or among thick undergrowth, or sometimes will sit with outspread wings upon a large bramble leaf, when the harmony of its colour and markings with those of the leaf is extraordinary and most deceptive. It flies naturally at about 11 P.M. and later, and towards midnight is much attracted by a strong light, around which it dashes in a vigorous and startling manner.

Very generally distributed in woods, especially those in

which birch and alder abound; on heaths among scattered birches; and very common about the alder-cars in fens; apparently throughout England, Wales, and Ireland; also the South and centre of Scotland, where it extends to the Clyde Valley in the West, and to Moray in the East, and is rather common in Perthshire. Abroad it is found throughout Central Europe, the temperate portions of Northern Europe, Northern Italy, Eastern Siberia, Tartary, and Japan.

### Genus 3. IODIS.

Antennæ of the male pectinated, the tip filiform; palpi minute; head smooth, transversely divided; thorax and abdomen slender, moderately smooth; fore wings broad, rather silky; hind wings thin and silky, faintly angulated behind.

LARVÆ long and slender, rather stiff; two small points on the second and anal segments.

PUPÆ among leaves.

We have but two species, which cannot be mistaken for each other—*I. vernaria* being bright emerald-green; *I. lactaria* faintly bluish-green, nearly white, and very much smaller.

1. **I. vernaria**, L.—Expanse  $1\frac{1}{4}$  to  $1\frac{5}{8}$  inch. All the wings broad, soft silky green, almost pea-green; on the fore wings are two white transverse lines, and on the hind one.

Antennæ of the male pectinated with short curved ciliated teeth, light brown, shaft white; palpi short and blunt, pale brown; face smooth, dark purple-red or vermilion, banded above by a transverse channel, the upper part of the head being whitish-green, and between the antennæ white; thorax rather downy, with raised scales at the sides, green; abdomen smooth, but downy, rather paler green; lateral and anal tufts inconspicuous. Fore wings moderately broad; costa

strongly arched; apex bluntly angulated; hind margin oblique and very slightly curved; dorsal margin a little filled out and softly ciliated; colour pea-green; first line white, so curved as to reach the dorsal margin not far from the base of the wing; second line also white, oblique, and much straighter, almost parallel with the hind margin; extreme edge of costa white; no trace of other markings; cilia green, tipped with white. Hind wings rather elongated; apical portion of the hind margin much rounded, and its middle portion bluntly angulated; anal angle squared; of nearly the same shade of green as the fore wings, but a little whiter toward the base; beyond the middle is a slender, slightly curved, or bent, white transverse line; cilia green, tipped with white. Under a strong lens all the green surface appears to be minutely frosted, from shining white atoms placed in transverse rows. Female extremely similar, but rather larger, stouter, and having simple antennæ.

Undersides of all the wings paler green, shading off to whitish-green on the dorsal margins of the fore wings, and the basal portion of the hind; the white transverse line faintly visible. Body green, legs to the knees also green; tarsi pale reddish-brown.

Not variable, but the colour is fugitive, changing to dirty yellow or yellowish-white under the influence of the slightest moisture or of almost any chemical preservative.

On the wing in July and the beginning of August.

LARVA rigid; moderately stout, but tapering a little to the head, which is deeply divided, the two lobes projecting forward into points, purple-brown; face flat, rather depressed, and when at rest placed close to the legs, which are drawn together; colour of the body pale green, roughened or shagreened, every tip of the minute roughnesses white; the second segment purple-brown, produced into two points which extend beyond the head; sometimes there is also a purple-red dorsal line; or the dorsal line is deeper green, and

there are slender yellowish-green lateral lines ; lateral fold raised into a conspicuous ridge ; spiracles yellow ; legs purple-brown ; prolegs green ; there are two projecting points on the anal segment.

August till May or June, on *Clematis vitalba* (traveller's joy), hybernating while very young on the stem of the plant, being then of a brown colour exactly resembling its bark ; changing to green in the spring, as the leaves come out. If touched or disturbed it falls from its food in a rigid condition, which is maintained for some time. From the pairs of points at each extremity, and the curiously whitened and shagreened appearance of its skin, it bears an extraordinarily accurate resemblance to the smaller twigs of its food-plant.

PUPA rather slender, tapering gradually, not glossy ; head and eye-covers a very little projecting ; limb-covers closely compacted ; those of the antennæ broadly sculptured with the forms of the pectinations ; wing-covers very minutely and closely covered with small wrinkles of incised sculpture ; segments smooth, but very dull ; cremaster large and conical, finished with several hooked bristles twisted together. Suspended by the tail in a slight silken cocoon among leaves.

The moth hides during the day in the thick masses of clematis, or in hedges where this plant grows ; and flies at dusk along hedges, and about thickets and other suitable covers, especially in chalky districts, and may be attracted by a strong light. Formerly to be found in the outskirts of London, indeed, I have myself taken it at Dulwich, but it is not now known to occur so near to the metropolis. Locally common in most of the Southern Counties, though scarce in Cornwall, and extending to Oxfordshire, Cambridgeshire, Bucks, and Worcestershire ; even more frequent in Essex and Suffolk, and found in Norfolk. The only record that I have farther north is doubtful, at Orton in Cumberland. In North Wales it is known to occur near Barmouth and at Colwyn Bay. In Scotland it appears to be unknown ; and in Ireland



the only reliable occurrence seems to be a capture, by the late Mr. R. S. Fetherstonhaugh, of a single specimen in Dublin, which Mr. Kane very reasonably suggests may have been accidentally introduced, on an imported clematis, in the larva state. Abroad it is found throughout Central Europe, the more temperate portions of Northern Europe except Finland, South-Eastern Europe, Central Italy, Corsica, Bithynia, Turkey, and the mountain regions of Central Asia.

2. *I. lactæaria*, *L.*—Expanse  $\frac{3}{4}$  to 1 inch. Very slender, small and weak; white faintly tinted with blue-green, which is extremely evanescent; two faint silvery-white transverse lines are continuous on all the wings.

Antennæ of the male pectinated with slender oblique ciliated teeth, white, the teeth whitish-brown; palpi small and very slender, and, with the face, pale olive-brown or yellow-brown; upper part of the head abruptly shining white; thorax weak and slender, greenish-white; abdomen smooth, glossy white; lateral tufts rather large; anal tuft small and conical. Fore wings blunt, of thin texture, and silky; costa arched; apex very bluntly angulated; hind margin a little oblique, but hardly curved; dorsal margin faintly rounded, strongly ciliated; texture thin and shining; colour extremely pale bluish-green, or white with a green shade; first line erect, indistinct, gently curved, white; second line also white, nearly erect, and tolerably straight; cilia rather long, white. Hind wings elongated, angulated behind; of the same tint of greenish-white, with a single slender, strongly curved, white central transverse line; cilia long, white. Female hardly stouter, extremely similar, but with simple antennæ.

Undersides of all the wings shining white, the basal portion and costa of the fore wings tinged with green. Body and legs silky-white.

Not variable, except, perhaps, a little in size; but the

faint tinge of green is so evanescent that it is only visible on specimens which, when captured, were freshly emerged, or have been reared, and also completely protected from damp.

On the wing in the latter part of May and in June.

LARVA very long and slender, rigid, anal flap produced prominently behind; head large, deeply bifid, and flattened in front, dark red; face whitish; body bright grass-green, undersurface paler; incisions of the segments rather paler; at each, on the back, is a bright ferruginous spot shaded on each side with yellow; second segment furnished with two projecting points. (C. Fenn.)

August to October on oak, birch, hazel, willow, dogwood, hawthorn, *Genista*, and sometimes on herbaceous plants; feeding at night; remaining upon its food-plant, rigidly extended, during the day.

PUPA very slender, with prominent eye-covers, and a rather sharp cross-ridge in front of them; antenna-cases long and very prominent at the shoulders, showing the shaft and pectinations; wing-cases rather long, the nervures prominently indicated; abdomen long, gradually tapering, curved back; anal segment hollowed beneath; cremaster tapering, long and slender, bearing some hooked bristles; colour bright pea-green; wing-covers more glaucous green; eye-covers and cremaster brown. In a very slight cocoon formed of a few threads in the drawn-together corner of a dead leaf, but holding fast by the anal hooks.

In this condition through the winter.

The moth hides during the day among the leaves of its food-plants, especially preferring the lower bushes, and may readily be disturbed by the beating-stick; but it shows no alarm, being one of the weakest in flight of the *Geometridæ*, and simply flutters into a neighbouring bush. Its natural flight at dusk is equally weak, about the same bushes. A constant inhabitant of the more open woods, and found in

lanes and field-sides in wooded districts, over the whole of the southern half of England, and in less abundance throughout the remainder; also common in Wales, but apparently only found in the South of Scotland in the Solway and Clyde districts. In Ireland it seems to be common wherever there are woods, or other suitable spots. Abroad it has a wide distribution through Central Europe, temperate Northern Europe, Northern Italy, the Balkan States, Southern Russia, Bithynia, Tartary, China, Corea, and Japan.

Genus 1. **NEMORIA.**

Antennæ of the male simple, ciliated; palpi minute; head rather rough, divided transversely in front; thorax slender, smooth; abdomen small, tapering, smooth; fore wings not especially thin, dull, triangular and rather pointed; hind wings somewhat narrow, angulated behind.

We have but one species.

1. **N. viridata**, L.—Expanse  $\frac{3}{4}$  to 1 inch. Fore wings rather narrow, dull green, fading readily to brownish-green; first line obscure, second distinct, white, the latter continued across the hind wings.

Antennæ of the male simple, rather thick; ciliated, pale brown; palpi short and slender, pale red-brown; face smooth, rich red-brown, edged above by a cross-channel; head rough on the top, dull green; thorax softly clothed with long loose scales, dull green, paler at the back; abdomen smooth, whitish-brown; lateral tufts whitish; anal tuft conical, light brown. Fore wings trigonate; costa gently arched; apex angulated; hind margin rather oblique and very little curved; dorsal margin straight, strongly ciliated; colour dull green, dusted with shining white scales; first line obscure and very slender, slightly curved, white; second line distinct, oblique, and a little sinuous, shining white; costa narrowly edged with pinkish-brown; cilia very glossy, green tipped with white. Hind wings decidedly elongated; angu-

lated in the middle of the hind margin; anal angle squared; colour the same shade of green as the fore wings, with a similar tendency to fading; just before the middle is a direct, slightly sinuous, but not curved, transverse white line; cilia green, with the tips white. Female similar, a very little stouter.

Undersides of all the wings of a rather softer green, with a slender shaded white stripe continuously. Body and legs greenish-white, the latter brown in front.

Apparently not very variable, but extremely liable to fading to a far more dull green or even yellowish-brown, in life as well as in the cabinet. Cumberland specimens in the collection of Mr. Sydney Webb have the cilia of a more smoky tint.

On the wing in May and June.

LARVA rather slender, somewhat flattened and tapering toward the head, which with the second segment is acutely bifid; anal segment ending in a pointed flap; the whole skin rough with fine granulations; ground colour full clear green or yellow-green; the roughnesses of the skin whitish; points on the head and second segment red; down the back is a purple-red stripe, or in some individuals this is interrupted on the middle segments, and, with some small whitish dashes, forms five acute diamonds: subdorsal line whitish; spiracular line yellowish- or whitish-green, in some specimens having in it small purplish spots on the eighth, ninth, tenth, and eleventh segments; on the undersurface are paler subspiracular and central lines; legs light red. In habit quiet, generally resting in an extended rigid posture. (Rev. J. Hellins.)

July and August on *Calluna vulgaris*, *Erica tetralix*, *Salix viminalis*, *S. caprea*, and birch; in confinement especially choosing hawthorn, and preferring the younger leaves or those from succulent shoots. Feeding at night, remaining upon the food-plant during the day.

PUPA rather cylindrical, very little thickened in the middle and abdominal segments, but slowly tapering; general colour pale dull brown; eyes darker brown, but not prominent; tongue and leg-cases all distinct but hardly raised, mottled with umbreous; antenna-cases very conspicuous, commencing on the top of the head as a strongly raised ridge, and extending to the ends of the wing-covers, sculptured throughout with cross-ridges which show the joints, shaded with umbreous; wing-covers abundantly sculptured with fine cross-lines and strongly ribbed, each nervure being prominent and shaded with dark brown; from the back of the second segment down the edges of the wing-covers is, on each side, a row of round black spots enclosing the spiracles, continued with a parallel similar row on the abdominal segments; between is a black dorsal stripe, which with them extends to the anal segment; cremaster large, elongated, triangular, tipped with a tuft of strong hooked bristles. In a rather open, slight cocoon of tough silk between dead leaves or rubbish on the ground.

The winter is passed in this condition.

The moth hides during the day among heather, or among sweet-gale, if present, or may occasionally be beaten out of hawthorn or blackthorn bushes growing upon the heaths. It flies of its own accord at dusk. It is excessively local, and almost confined to extensive heaths and mosses and heathy fens; but is common on the heather-covered low cliffs on the sea-coast of Hants and Dorset, in the open portions of the New Forest, and elsewhere on the extensive heaths of these two counties. Formerly it was plentiful in one locality in Worcestershire, an open piece of common or village-green. In the year 1872 four specimens were taken at Horning Fen, Norfolk, and it has long been well known in the mosses of Westmoreland and Cumberland. So far as I know it has not been seen in Wales, and the only record which we possess for Scotland is that by Dr. Buchanan White

at Dumfries, which requires confirmation. It was included in Mr. E. Birchall's Irish List, but probably in error; Mr. Kane has investigated the records in that country and has found them to be referable to *Hemithea thymiaris*. Abroad it is found almost all over Europe, except Italy and Portugal, but including Turkey; also in Bithynia, Armenia, the mountainous regions of Central Asia, Tartary, the Corea, and China.

### Genus 5. PHORODESMA.

Antennæ of the male short, strongly pectinated to near the tip, which is filiform; palpi slender; head rather rough on the top; thorax and abdomen very smooth, the latter short; fore wings rather elongate, bluntly pointed; hind wings somewhat elongated, with smoothly even, rounded hind margins.

LARVÆ short, rugose, clothing themselves with small fragments of vegetable substances.

We have two species, readily recognised.

A. Wings bright green, with white lines and discal spot. *P. smaragdaria*.

A<sup>2</sup>. Wings rich pea-green, with chequered pale brown borders. *P. bajularia*.

1. *P. smaragdaria*, *Hüb.*—Expanse  $1\frac{1}{4}$  to  $1\frac{3}{8}$  inch. Body and wings soft bright green; costa of fore wings edged with fulvous; discal spot and transverse lines white; hind wings whiter toward the base.

Antennæ of the male pectinated with short, curved, ciliated teeth which do not reach the apex, white; palpi rather projecting, pale tawny; face and head smooth rich green except the lower part of the face, which is pale tawny; collar whitish-fulvous or pinkish-white; thorax covered with very soft long scales, light green, shading off to paler at the back; abdomen rather slender, shining white, every segment barred



across the back with pale green; lateral and anal tufts white. Fore wings not very broad, elongated, costa very slightly arched throughout; apex bluntly angulated; hind margin very even, oblique and gently curved; anal angle rather fully formed; dorsal margin very gently rounded and softly ciliated; soft delicate green; the extreme edge of the costa of the pale fulvous of the collar; first line yellowish-white, very incomplete, showing only as whitish curves between nervures; second line more distinct, white or pinkish-white, rippled, nearly direct, and disposed throughout in slender flattened curves between nervures, yet scarcely attaining the costa; discal spot distinct, rounded, white; cilia green tipped with white. Hind wings rather elongated, smoothly rounded behind, but the anal angle rather squared; bright green shading off to shining white at the costal margin and the base; sometimes a white dash from the costal margin indicates the mere beginning of a transverse white line; cilia green, tipped with white. Female quite similar except that the antennæ are simple and the body is shorter and thicker.

Underside of the fore wings of the same beautiful green; the costa edged as on the upper side; the discal spot and second line also visible, white, and the dorsal margin shading to silvery-white. Hind wings of the same shade of green, with a white central dot, and beyond it a curved transverse series of white crescents. Body green, but the abdomen paler; tibiæ green; tarsi brownish-white, shaded with pale tawny.

Usually not variable except in the distinctness of the second line, but in the collection of Mr. F. J. Hanbury is a specimen devoid of both transverse white lines.

On the wing in June and the beginning of July. A casual specimen of a second generation has been reared, by Mr. H. J. Turner, in September.

LARVA one inch and a quarter long, of a dirty greyish colour with darker lines along the body, the skin very rough

and the head and legs brown ; but, owing to its being covered so entirely with the dead and brown portions of its food-plant, it is extremely difficult to make out the exact markings. (G. Elisha.)

August till May on *Artemisia maritima* (Sea-wormwood) on the coast, but in confinement feeding equally upon *Artemisia abrotanum* (Southernwood), abroad, where it is not restricted to the sea-coast, upon several other species of *Artemisia*, as well as on tansy, ragwort, and millefoil. So soon as it leaves the egg it begins to form a sort of covering by decorating itself with small vegetable fragments : after hybernation, while still young, and as soon as its food-plant begins to throw up young shoots, it casts a skin, and then, as it eats, it cuts off the small whitish tips of the leaves and places them upon its back, securing them to the hairs by some glutinous secretion. When older it is said, after casting a skin, to remove each fragment of leaf from the old skin and place it carefully upon the new. So long as it is inert the appearance it shows is that of a small mass of dried vegetable morsels held together by some slight attachment, such as spider's-web, but when it stretches its body to feed, the distribution of the fragments along its dorsal surface, each attached to a single hair, becomes obvious. This, however, takes place usually at night, and during the day the creature is so efficiently protected that, until familiarised with its queer appearance, no one would think of taking any notice of so worthless-looking a bunch of fragments. Fresh and longer morsels are added as it continues to grow, and the only cocoon made consists of these fragments united together with silk.

A very remarkable circumstance about this larva, but one fully substantiated, is that no apparent inconvenience is caused to it by the complete submergence of its food-plant in sea-water, which takes place at exceptionally high tides.

PUPA much like that of a butterfly ; the anterior portion a

little flattened; eye-, limb- and antenna-cases strongly marked, the latter sculptured with the forms of the pectinations; wing-covers depressed in the middle, all the nervures much thickened into ridges and darkened in colour; abdomen regularly tapering; cremaster flattened beneath, triangular, the apex furnished with a tuft of hooked bristles; general colour pale drab or pale yellowish-brown, with a dorsal row of rather squared darker brown spots; spiracles placed each in a black spot at the edges of the wing-covers; dorsal region also ridged and wrinkled, and all the surface dull and roughened. In the loose cocoon of silk and larval clothing already referred to.

The moth hides during the day among grass and low-growing herbage just above high-water mark, and at the edges of salt marshes, on the coast, but is rarely captured in the imago-state. The first specimen noticed in this country seems to have been recorded by Curtis ("British Entomology"), who states that one specimen "was reared from a larva, found by Mr. Parsons at Southchurch, Essex, in the year 1826." Nearly twenty years later (1845) five specimens were captured by my (now) veteran colleague, Mr. J. W. Douglas, among grass on the sea-wall at St. Osyth, Essex; these specimens are still in evidence in the collection of Dr. P. B. Mason at Burton-on-Trent. It was not till about 1880 that Messrs. Machin, Elisha, and other hard-working London collectors succeeded in discovering its larva on the Essex coast, and made it comparatively a common insect in our collections. The moth is still *very* rarely captured, but a single wing, doubtless dropped by a bat, was picked up by Mr. J. J. Walker, R.N., at Sheerness, Kent, in 1870, and a single example was captured in the same locality by Mr. Hodgson in 1872. But every year the curious larva is found upon the Essex coast, sometimes in considerable numbers, and from these, and specimens reared in confinement from the egg, our cabinets are supplied.

I have no knowledge of its existence in these Islands beyond the Counties of Essex and Kent; but on the Continent it is found at Wiesbaden, Frankfort and Nassau in North Germany, very far from the sea, and is recorded from Southern and Western France, Central and Southern Germany, Spain, Italy. Eastern Europe, Bithynia, Armenia, Tartary, and Siberia.

2. *P. bajularia*, Schiff.; *pustulata*, Staud. Cat.—Expanse 1 to  $1\frac{1}{4}$  inch. Body and wings of a very soft full pea-green, blotched at the anal angle of the fore wings and along the margin of the hind with fulvous and white, cilia chequered with the same.

Antennæ of the male strongly pectinated with solid ciliated teeth three-fourths of their length, the remainder simple, smoky-white; palpi small, slender. of the same colour; head and face smooth, snowy-white; collar green, edged with white, and the front of the remaining portion of the thorax barred with white, the rest rather rough, pea-green; abdomen smooth, green at the base, white or brownish-white behind; lateral and anal tufts white. Fore wings somewhat ovate; costa decidedly arched; apex bluntly angulated; hind margin very smoothly curved and rather oblique; dorsal margin nearly straight, strongly ciliated; colour rich soft pea-green; a greenish-white stripe on the costa from the base narrows off beyond the middle; first line white, erect, slender. except the portion near the dorsal margin, which is expanded into a narrow angulated blotch; second line also white, sinuous and extremely slender, but passing through a large brownish-white blotch which extends from a little beyond the middle of the dorsal margin to the anal angle, and contains a fawn-coloured cloud; discal spot minute, red-brown; cilia white, chequered with fawn colour or pale purplish-brown. Hind wings rather elongated, rounded behind; rich pea-green; central spot a red-brown dot in a faint white streak; on the costal margin beyond the middle is a large ovate whitish-

brown spot containing a fawn-coloured cloud ; this is flattened on the margin by another such spot, in which the fawn-coloured portion is a crescent, and this by four similar but smaller spots containing flatter similar crescents along the hind margin, the last uniting with a large similar pale spot at the anal angle which contains two fawn-coloured streaks ; extreme hind margin edged with a red-brown line ; cilia brownish-white, regularly chequered with red-brown. Female larger, very similar, but with the antennæ simple, and the abdomen shorter and thicker.

Very few insects are more beautiful than this, when freshly emerged, and few fade so rapidly while still alive ; but, if carefully preserved, the fading in the cabinet is comparatively slow.

Underside of the fore wings pea-green, shading off to white on the dorsal margin, and especially so at the anal angle, where the blotch of the upper side is represented in white ; discal dot red-brown. Hind wings rather paler green, shading off along the margins to greenish-white, central spot a red-brown dot ; beyond it is a curved, deeper green, transverse stripe ; cilia as on the upper side. Body and legs white ; the knees of the front pair of legs barred with brown.

Usually not variable except in size, and a little in the extent and depth of colour of the pale blotches. A specimen in the collection of the late Mr. F. Bond is of the purplish-red colour of *Ellopiæ fasciaria*. Captured specimens are sometimes dull pale yellow from excessive fading.

On the wing at the end of June and in July. Rarely, specimens of a second generation have been found in September.

LARVA. Body flattened, attenuated toward the head, which, with the body, is reddish-brown ; dorsal line fuscous ; subdorsal line wavy, fuscous ; and underneath the spiracles is a row of fuscous spots ; on each segment from the fifth to the ninth inclusive, and on the twelfth, is a pair of dark

brown papillæ, each placed outside the subdorsal line, and having a dark spot on the apex, furnished with a single hooked bristle, to which the gnawings are attached with silk. Being very curious to know how this was done, I put a half-undressed individual into a glass-covered box, together with an oak bud just bursting into leaf. Before eating, it firmly fixed itself by its anal prolegs to the bottom of the bud, took hold of one of the brown scales which incase the bud by the top with its jaws, and drew it with some force, with the intention of pulling it off if loose; but as it was still firmly fixed at its base, the larva, after two or three strong pulls, began to gnaw it off at the base; afterwards holding the scale with its legs it covered the curved side with silk, and fixed it to one of the naked papillæ, winding silk about it at the point of connection. In the same manner every other naked papilla was clothed with a bit of bud-scale with little regard to its shape, and sometimes a second piece was affixed to a papilla which already had one. This was not rapidly accomplished, some hours being occupied in the operation of dressing. The infant larva, as soon as hatched, fixed a bunch of minute gnawings of oak, green and white in colour, to each of the minute papillæ; and one, which was furnished only with a rose-petal, furnished its back with "rosy favours." (Rev. E. Horton.) At each change of skin the same process is gone through, and it does not appear that the fragments are removed from the old skin to the new. As it rests, its body is so hunched as to give its covering quite the appearance of an accidental heap of bud-scales or fragments of dead leaf.

July to May or June upon oak, hibernating while still small. Abroad it is said to feed also upon alder and plum.

PUPA short and thick, the abdomen rapidly tapering; edges of the wing-covers raised into ridges; antenna and limb-cases compact, rough, the wing-covers also rough, brown; the nervures, and the edges of the limb-cases, defined by dull



black lines, crossed everywhere by stippled lines of mixed black and brown; dorsal region brown, much streaked and spotted with dull black; abdominal segments red-brown, clouded and edged with dull black, rough, but not distinctly pitted; cremaster flattened beneath, triangular, tipped with hooked bristles which are fixed tightly to the silk of the very slight cocoon; upon this last are placed the bits of brown bud-scale used by the larva as its covering.

The moth hides during the day among thick undergrowth and masses of honeysuckle in oakwoods, and is not easily induced at that time to fly, though occasionally it may be beaten out of oak branches; but directly after sunset it becomes lively and dances briskly over the herbage and about the wood paths, sometimes descending almost to the ground, then mounting with a sort of bounding flight above the oak-trees. If a female is hidden among the undergrowth, quite an assemblage of males may be seen hovering and fluttering about the neighbourhood. Later at night it seems to take more extensive flights, and I have even taken it at a gas-lamp in Camberwell, situated at a considerable distance from any suitable oakwood. Mr. Chas. Fenn tells me that it has been attracted by light even into his house at Lewisham. It formerly inhabited portions of the North London suburbs also, being found in the woods at Hampstead and Highgate, and probably may be there still. Elsewhere it seems to be confined to woods and their immediate neighbourhood, and often to very restricted areas within them, but with these limitations is to be found throughout the Southern Counties of England, also the Eastern to Lincolnshire, and, with the exception of Cornwall, the Western to Salop; in the Midlands it is very rare, but is recorded in Warwickshire, once in Leicestershire, and once at Swynnerton Old Park, in North Staffordshire. It seems to be unknown farther North, and I find no record for Wales or Ireland. Abroad it is found through Central Europe, Northern Italy, Southern Spain, Livonia, the Balkan States, and Southern Russia.

Genus 6. **HEMITHEA.**

Antennæ of the male sharply serrated, palpi slender, head smooth, but having a transverse furrow; thorax slender, smooth; abdomen slender, furnished with several small crests; fore wings trigonate, rather pointed; hind wings angulated behind, scalloped within the cilia.

We have but one species.

1. **H. thymiaria**, *L.*; **strigata**, *Staud. Cat.*—Expanse 1 to 1 $\frac{1}{4}$  inch. Dull dark green, or greyish-green; on the fore wings two, and on the hind one, undulating transverse white lines; cilia of all the wings silvery-white, chequered with black-brown.

Antennæ of the male sharply serrated or notched, ciliated, light brown, white at the base; palpi curved, pointed, red-brown; face smooth, chocolate-red, banded above by a transverse channel; head rather rough, dull green, but between the antennæ white; thorax narrow, dull green; abdomen slender, whitish-brown, having two or three obscure brown dorsal crests upon the anterior segments; lateral and anal tufts brownish-white. Fore wings moderately broad, somewhat triangular; costa gently arched, more so toward the apex, which is bluntly angulated; hind margin gently curved and very faintly crenulated; dorsal margin a little filled out, ciliated; colour dull dark green, very minutely dusted with white; extreme edge of costa brown; first line very slender, rather oblique and sinuous, faintly white, edged outwardly with darker green; second line somewhat parallel, but more sinuous, slenderly white, edged inwardly with dark green; cilia silvery-white, strongly barred or chequered with black-brown. Hind wings decidedly elongated, rounded in front, but the hind margin produced in the middle into a decided angle or protruding point, and the anal angle squared; of the same dull dark green as the fore wings; central spot a darker green streak; beyond this, in the middle of the wing, is a sinuous white transverse line, inwardly edged with dark

green, and having a protruding angle in its middle; extreme margin edged with a scalloped black-brown line; cilia silvery-white, barred at the tip of each scallop with black-brown. Female very similar, but a little larger and stouter.

Underside of all the wings shining greenish-white; costa of the fore wings broadly tinged with light brown; cilia chequered as on the upper side. Body and legs pale brown.

Not variable, but subject in a high degree to fading, especially so during life, so that, unless captured immediately after emergence, no specimen which has flown is really perfect in colour.

On the wing at the end of June and in July.

LARVA elongated, rigid, rather rough, narrowed in front; head and second segment strikingly bifid; general colour pale green; head, legs, prolegs, and bifurcations of the second segment reddish-brown; a dull purple dorsal stripe from the second to the sixth segment terminates in a triangular blotch produced laterally; on the third and fourth segments this stripe has a whitish edging, through which runs a purple line; last three segments tinged with purplish-brown; those between the sixth and the eleventh have each a reddish dorsal spot, edged on each side with yellow; ventral stripe cloudy-white, margined with pale purple, most conspicuous on the fifth and sixth segments. (C. Fenn.)

Extremely variable; one of those figured by Mr. Buckler is purple, with an interrupted black dorsal line, most distinct on the first and last three segments; parallel white lateral lines on the former, and on the following five middle segments each a large white **V**, its apex pointing forwards. Another, although purple at each end, has these middle segments bright green, each with a white bar in which is a black spot; and another is light bright red-brown with less distinct markings.

August to May or June, on oak, hawthorn, blackthorn, birch, lime, rose, honeysuckle, jasmine, and currant; but the

young larva before hybernation seems to feed upon herbaceous plants, such as *Tormentilla* and mugwort (*Artemisia vulgaris*). Very stiff in its posture when at rest in the day-time, in a perfectly straight position, its head depressed close to the legs, which also are packed closely together and pointed forward.

PUPA elongate, tapering to the anal extremity, which is hooked; very pale brown; wing- and limb-cases darker brown; dorsal shade blackish. In a slight cocoon among leaves on the tree. (C. Fenn.)

The moth hides by day among undergrowth, and is readily disturbed by the beating-stick, and easily captured; at dusk it flies of its own accord. Common in woods, especially the more open portions, and found also in lanes and well-wooded hedges throughout the Southern, Eastern, and Western Counties of England; very scarce in the Midlands, but has been taken in Derbyshire and Leicestershire; also throughout the more northern counties to Durham and Cumberland; but I find no record for Scotland. Common in Wales, extending to Pembrokeshire; scarce in Ireland, and usually found only singly, but it has been captured in Wicklow, Waterford, Cork, Kerry, Galway, Westmeath, Cavan, Tipperary, Sligo, and Donegal. Abroad it has a wide range through Central Europe, the South of Sweden and North-east of Spain, the North of Italy, Sicily, Corsica, Dalmatia, Livonia, Southern Russia, Bithynia, Asia Minor, Tartary, China, Corea, and Japan.

### Family 3. ACIDALIIDÆ.

Antennæ pectinated or threadlike; palpi small: head smooth, and in many species divided in front by a transverse groove; thorax and abdomen slender; fore wings of rather thin texture, and of moderate breadth; hind wings with vein 5 fully developed and arising at, or below, the middle

of the cross-bar ; vein 8 joined toward the base with vein 7, but rapidly diverging. Delicate species, usually of weak and gentle flight.

LARVÆ usually long and slender, slightly thicker behind ; in many species given to coiling themselves when disturbed.

PUPÆ usually in the earth.

### Genus 1. **EPHYRA.**

Antennæ of the male pectinated ; palpi small ; face convex, smooth, edged above by a transverse fissure ; head smooth ; thorax slender, slightly fluffy with raised scales ; abdomen slender and smooth ; fore wings trigonate, pointed, and a little retuse ; hind wings rounded, but squared at the anal angle.

LARVÆ slender, without humps, head slightly divided.

PUPÆ angulated, rather like those of butterflies of the genus *Pieris*, and suspended by the tail and a silken girth in the same manner.

The six species may readily be recognised.

A. Fore and hind wings with ringed discal and central spots.

B. Wings red-brown or purplish-brown. *E. porata.*

B<sup>2</sup>. Wings pale yellow. *E. omicronaria.*

B<sup>3</sup>. Wings grey, with purple marbling. *E. orbicularia.*

B<sup>4</sup>. Wings white, faintly clouded with grey or purplish-grey. *E. pendularia.*

A<sup>2</sup>. Fore and hind wings devoid of ringed spots.

C. Fore wings reddish-drab, hind wings whiter, with one central red-brown line. *E. punctaria.*

C<sup>2</sup>. Wings pale fulvous or yellow-brown, with three transverse brown lines. *E. trilinearis.*

1. **E. porata**, L.—Expanse 1 to 1½ inch. All the wings pale purplish-brown or reddish-brown, dusted with tawny ;

a white dot in a dark ring, on each wing, is followed by a purple-brown central line; other lines uncertain.

Antennæ of the male pectinated with slender ciliated teeth for two-thirds of their length, the rest threadlike, dull brown; palpi small and slender, pale brown; eyes light brown; face very smooth and convex, pale reddish-brown, separated from the upper part of the head by a deep transverse furrow; head smooth, whitish-brown; thorax narrow, moderately smooth, pale brown dusted with purple-brown; abdomen smooth, slender, its base of the same colour, remainder grey-brown dusted with black; anal tuft yellow-brown. Fore wings not broad, pointed; costa very flatly arched; apex sharply angulated; hind margin just below it very faintly retuse, then gently curved, and more so towards the anal angle; dorsal margin tolerably straight, well ciliated; colour red-drab or light red-brown, much dusted with purple-brown; first line slender and obscure, purple-brown, often hardly visible, but accentuated by minute black dots on and between the nervures; second line represented by a curved series of dull black dots; between these is a rather direct purple-brown thread or very narrow stripe representing the central shade; and close to the inner side of this, often touching it, is an oval or circular red-black or black-brown ring, with a white centre, as a discal spot; extreme hind margin dotted with black; cilia pale brown. Hind wings rather long, rounded behind, yet with a faint indication of an angle in the middle of the hind margin; anal angle squared; rather paler reddish-brown than the fore wings, and more dusted with purple-brown; near the base is a very faint indication of a blackish transverse line, mainly visible on the nervures; central spot rather large, ovate, white, ringed with brown-black; lying right across it is a continuation of the purple-brown central line of the fore wings as a complete narrow cloudy stripe; beyond this is another line composed of minute dark brown dots; extreme hind margin edged with purple-brown streaks; cilia pale brown.



Female very similar, a little stouter, and having threadlike antennæ.

Undersides of all the wings whitish-brown; the fore wings tinged, on the costal half, with red-brown; discal and central ringed spots just indicated, and the outer dotted lines more distinctly so. Body and legs pale brown; tarsi red-brown.

Not very variable, but the central line or stripe is often obscure, or, on the other hand, sometimes strongly emphasized, and clouded with purple-brown on its margins; the ordinary first and second lines are equally, or more, inconstant. In the second brood there are often small purple clouds in a row near the hind margin, indicating a sub-terminal line. Occasional specimens have the fore wings so much suffused with dull red as to obscure the markings. In the collection of Mr. Sydney Webb is one of an almost unicolorous *pink*; and another in which the *first* line is very distinct and sharply defined, also strongly angulated. In that of Mr. F. C. Woodforde is a strongly dusted female having a broad cloud of brilliant red upon each fore wing.

On the wing at the end of May and in June; also as a very partial second generation in August and September; in the year 1862 I captured it in October, but such a circumstance is rare.

LARVA. Head slightly broader than the second segment; body slender, cylindrical and rather rugose, the roughness arising from transverse division of the segments into narrow sections, which emit small bristles; fawn-colour, with the head of the same colour, and delicately reticulated with amber-brown; on the dorsal area of the body are five or seven dotted white rivulet lines, very inconspicuous except under a good lens; on each segment are four dark brown dots forming a square, and on the side of each segment, particularly observable from the fifth to the tenth, is an oblique dark mark, broad at the anterior extremity, but

gradually narrowed as it proceeds downward and backward; ventral area paler, with several dark markings, particularly on the ninth segment, legs and prolegs concolorous with the body. A less common variety is pale apple-green with a reddish head. (E. Newman.)

In one of the varieties figured by Mr. Buckler there is a broad white spiracular stripe, rising to each of the oblique black marks and suddenly falling at its upper end; another has transverse blackish dorsal bars.

June and July, and a partial second generation in September and October; on oak and birch. When at rest it stands with its anterior extremity free, but not stiffly erect, rather bending into a sort of arch.

PUPA much like that of a little slender butterfly, rather truncate in front, with points at the shoulders; slender and tapering behind; pale green with two rows of darker spots on the back, and two round spikes on the cremaster, hooked at their tips. On the underside of a dead leaf where a silken carpet has been prepared by the larva, to which the hooks of the cremaster are attached; also having a silken girth across the back. In this condition through the winter.

The moth sits in the daytime in thick bushes of oak or birch, and if disturbed flits gently away to a similar shelter. Its natural flight is at dusk, but it seems seldom to be captured at that time, yet later at night will come to a strong light, and has been found at sugar, and at heather-bloom. Almost restricted to woods and wooded heaths: formerly rather common in the London district, whence it seems now to have almost disappeared: still to be found, though usually in no great abundance, from Kent to Devon, and in the Scilly Isles: also through Somerset, Gloucestershire, Bucks and Oxfordshire; very uncommonly in the Eastern Counties, but more frequently in the West, in Herefordshire, Worcestershire, Cheshire and Lancashire; almost absent from the Midlands, except some heathy woods in North Staffordshire; once

recorded near York, and found in the woods of Westmoreland and Cumberland. Probably widely distributed in Wales, since it is recorded as common near Penrhyn Dudriath in North Wales, and in Glamorganshire, and was found by Mr. W. H. F. Blandford near Saundersfoot in Pembrokeshire. In Scotland it occurs occasionally in Ayrshire and Argyleshire and elsewhere in the South-west, and also in Perthshire; but is apparently absent from Ireland. Abroad it seems to be found throughout Central Europe, and the greater part of Southern Europe, including Spain; also in Armenia, Bithynia, some parts of Asia Minor, and in the United States of North America.

2. **E. punctaria**, L.—Expanse 1 to  $1\frac{1}{4}$  inch. All the wings reddish-drab or pale reddish-brown, flushed and dusted with brighter red; a slender dark red or purple-red stripe passes in a regular curve through all the wings continuously from costa to costa; sometimes a few purple clouds lie towards the margins; central ring-spots absent.

Antennæ of the male pectinated with oblique solid ciliated teeth three-fourths of their length, thorax simple, pale brown; palpi very small and slender, light brown; eyes black; face smooth and silky, convex, pale red-brown, edged above by a transverse furrow; head whitish-brown; thorax smooth, very light brown; abdomen similar at the base, remainder darker but barred with the paler colour; anal tufts very small, light brown. Fore wings a little broader than in the last species—which it somewhat resembles—costa flatly arched; apex sharply angulated; hind margin below it faintly retuse, then filled out and only curved off near to the anal angle; dorsal margin rather full, thickly ciliated; colour pale reddish-brown, faintly dusted with purple-brown; first line represented by five minute black dots in a curve; second line by a full series of similar dots; between these in the middle of the wing is a slender direct purple-red transverse stripe or central shade; discal spot not represented; hind margin

minutely dotted with black; cilia shining pale brown. Hind wings very faintly and obscurely angulated behind, squared at the anal angle, and a little so at the apex; whitish-brown with a faint tinge of red, but somewhat dusted with dark purple-brown; the first and second lines of the four wings continued in the same manner in dots, and the central stripe so evenly continued as to form a semicircle on the four wings; hind margin edged with fine streaks of dark brown; cilia pale reddish-brown. Female very similar, but a little stouter, and having simple antennæ.

Underside of the fore wings whitish-brown, tinged with red-brown on the costal half, and strongly dusted, especially towards the base, with blackish-brown; hind wings whiter and less thickly dusted; the central stripe of all the wings faintly indicated in smoky-black, but the second line of black dots more conspicuous throughout. Body whitish-brown; legs pale red-brown.

Rather variable in the distinctness of the dots of the first and second lines, which often are nearly obsolete, or else obscured by red dusting; also in the colour of the central stripe, from bright red to brown. In the collection of Mr. J. Harrison, of Barnsley, Yorks, is a specimen having this stripe normal from the costal margin to the middle of the wing, but there curved rapidly inward, so that instead of attaining the dorsal margin, it runs quite in to the base. In that of Mr. W. G. Blatch is one of a unicolorous yellow-brown, devoid of this stripe altogether; and Mr. Sydney Webb has two specimens in which it is broken up into short streaks upon the nervures. He has also a specimen in which the dots of the second line are united into a full and much dentated line, continued upon the hind wings and there slightly angulated. In Mr. W. H. B. Fletcher's collection is a curious specimen in which this second line, tolerably complete, is diverted and makes a great curve inwards, above the anal angle, so as to avoid a space in which small brown dots surround a pale patch. In that of Mr. F. C. Woodforde is

one in which the stripe is dark purple and throws out clouds of the same colour toward the second line; the continued stripe on the hind wings is also purple. Another specimen in that collection has a brilliant red cloud in the middle of each fore wing. A more permanent variation occurs in the second generation, the central stripe in it being scarcely so strongly marked, and the specimens themselves usually rather smaller, but their beauty is enhanced by the presence of a row of small purple-brown or purple-grey clouds outside the second line. Mr. F. Merrifield, in the course of his experiments upon pupæ, found that in all the pupæ which he could force out in the same season—as a second generation—these purplish clouds were present, but that those of the same brood kept through the winter produced moths of the normal colouring; and also that if he produced an artificial winter by means of ice, and exposed such pupæ to it, afterwards bringing out the moths before the winter, the same spring form was produced. Those, on the other hand, which he forced out most rapidly showed a tendency to distinctness of all the transverse lines as well as of the purple clouds.

On the wing at the end of May and in June; and in a partial but constant second generation at the end of July, and in August.

LARVA slightly swollen at each end, but especially behind; head rather quadrate, the angles rounded, pale green, with a brownish shade in the middle of each lobe, and two indistinct yellowish lines half across the face; general colour either tawny or bright emerald green; dorsal line black, conspicuous at each extremity, and forming a triangular blotch on the anal segments; spiracular lines dark purple-brown or black-brown; a black marking of a horseshoe shape bisects the dorsal line, and joins the spiracular lines, on each segment from the fifth to the tenth; these markings are very conspicuously and broadly edged below with pale yellow; legs and prolegs red-brown; undersurface pink or rose colour,

with numerous whitish lines, and a blackish blotch on the ninth segment; whitish between the prolegs.

June and July, and a partial second generation in September; on oak and sometimes birch; feeding at night; resting by day on the twigs and leaves.

PUPA flattened and very like that of a little butterfly; the head-cover smooth and squared, and the front portion extremely truncate, the wing shoulders projecting in a small point on each side; limb and antenna-covers closely packed and but little indicated; wing-covers very smooth, and only showing indications of the nervures; dorsal region roughened, and minutely pitted and wrinkled, especially in the front part of each segment, also ornamented with a small row of brown spots on each; abdomen elongated and very gently tapering; all except the hind borders of the segments roughened with minute pitting; cremaster long and thick, rounded and bluntly terminated, but furnished with minute curled bristles; colour bright green, pale yellowish-brown, or pinkish-brown; at the back of each wing-cover is a brown streak; cremaster dark brown. On a small silken carpet, on the underside of a fallen oak-leaf; the bristles of the tail fixed in the silk, and a thread of the same placed securely across the back.

The moth sits during the day on the underside of a leaf of oak or birch, among undergrowth, or in the lower branches of the trees, and is readily disturbed by the beating-stick, when it flies hurriedly to a similar shelter. At dusk it flies gently about wood paths and the more open parts of woods, and will then come occasionally to the sugar placed on trees for the benefit of *Noctua*, or, in the second generation, to heather-bloom. Later at night it is not insensible to the attractions of a strong light. Not wholly confined to woods, but frequenting oaks in more open ground occasionally; formerly to be found in some parts of the suburbs of London, whence it appears now to have disappeared. Still quite



common in the wooded districts of the Southern half of England, and more local or scarcer throughout the rest of the country, having been taken once in Northumberland. Farther north, in more wooded districts, it is again common, and I have even picked up living pupæ under oak-leaves lying upon the ground, in Stirlingshire; common also in Perthshire, found in Renfrew, Dumbartonshire, Argyleshire, Ayrshire, and other districts of the South and West of Scotland, much more rarely in Kincardineshire, Aberdeenshire, and Moray, which seems to be its northern limit with us. In Wales I find no record at all, yet cannot believe it to be absent. In Ireland it seems to be almost unknown, but Mr. Kane tells me that two specimens have been taken at Clonbrock, Galway, one of them by himself. Abroad it seems to occur throughout Central and Southern Europe, also in Livonia, Finland, Bithynia, and Khorassan.

3. **E. trilinearia**, *Bork*; **linearia**, *Staud. Cat.*—Expanse 1 to  $1\frac{1}{4}$  inch. Fore wings silky, soft rich yellowish-fulvous, with a slender purplish-brown central stripe; first and second lines, when visible, slender and similar in colour; hind wings rather more ochreous, with similar lines and stripe.

Antennæ of the male pectinated, for two-thirds of their length, with oblique solid ciliated teeth, the remaining portion simple, yellow-brown; palpi of the same colour, very small; tongue well developed; face smooth, convex, purple-brown; head rather rough, pale drab; thorax slender, yellow-brown; abdomen smooth, whitish-brown, tinged at the base and anal tuft with ochreous. Fore wings longer and more pointed than in the last species; costa gently arched; apex sharply pointed; hind margin beneath it faintly hollowed and not much curved off, the anal angle being well formed; dorsal margin almost straight, strongly ciliated; colour smooth pale reddish-brown; first line faint, rather oblique, but rounded back close to the costa; some distance beyond it is a conspicuous narrow purple-brown stripe or central line,

followed at a short distance by the usual second line, of the same colour, but often only visible as a series of minute dots upon nervures, always showing these dots most distinctly where they are united into a slender line; hind margin edged by a series of short slender purple-brown streaks, sometimes forming a fine line; cilia glossy, yellow-brown. Hind wings rounded behind, or else showing the faintest possible angle in the hind margin, squared at the anal angle, and in some degree at the apex; paler yellow-brown; near the base is a very slender purple-brown transverse line; in the middle, a slender stripe very similar to that of the fore wings; and beyond it a very fine delicate line of the same colour, undulating and dotted and slightly angulated in its middle; extreme hind margin edged with a purple-brown line or series of streaks; cilia pale yellow-brown. Female accurately similar, but with simple antennæ and a rather stouter body.

Underside of the fore wings shining pale yellow-brown, with a deeper tinge along the costa, and a paler along the dorsal margin. Hind wings of a more creamy yellow; all the lines slenderly indicated, in each, in smoky-black. Body and legs whitish-brown; the tarsi redder.

Variable, as already indicated, in the distinctness of the first and second lines, and in their connected condition, or resolution into small dots; also rather uncertain as to the more distinct central stripe; in this last the mutability seems to be nearly confined to the second generation, this stripe being in it sometimes rather indistinct, and often affected by a considerable clouding of the ground colour with tawny. One such, in the collection of Dr. Mason, is reddish-ochreous, with the stripe purple-red. On the other hand, a specimen of this second generation reared by Major A. Picklin is absolutely devoid of the transverse lines and of the tawny clouding, being of a unicolorous soft yellow-fulvous; and Mr. H. J. Turner has a quite similar example. In less rare, but still very uncommon, specimens the central stripe is black and most conspicuous—

this form I have seen in several collections. One in Mr. Sydney Webb's cabinet is further shaded off from this stripe inwardly so as to present a broad cloudy band ; another has this stripe placed almost close to the first line, and not very black, the rest of the wings being without markings ; and a third, very different, specimen is of a most extraordinary purple or liver colour, the markings obscured, but the costal margins and apex of fore wings blackened. Mr. W. H. B. Fletcher has a variety curiously following in the manner of one in the previous species—having the second line driven out of its proper course to make room for an adventitious brown ring above the anal angle.

On the wing in May and June, and as a partial, but frequent, second generation in August and September.

LARVA. Head broad, light brown, faintly reticulated at the sides with darker brown ; mouth white ; body a little flattened, much wrinkled, ridged down the sides, light brown ; dorsal line pale yellow edged on each side by a slender dark brown line, on either side of segments five to nine is a rather oblique black-brown streak edging a long yellow blotch in the region of the spiracular line, this yellow colour being in some degree diffused over the rest of the spiracular region ; undersurface, with the legs and prolegs, pinkish-brown.

Or—Head and prolegs bright red-brown ; body bright light green, dorsal line indicated by the two slender bordering blackish lines ; the yellow blotches as before, but without the brown streaks ; remainder of the spiracular region more striped with yellow or white ; and the subdorsal region delicately and irregularly streaked with the same.

June, July, and the beginning of August, and as a (partial) second generation, in September ; on beech (*Fagus sylvatica*).

PUPA extremely truncate or squared in front, with minute projecting points at the shoulders ; the limb and antenna-

covers closely compacted and rather smooth: wing-covers silky, not visibly sculptured, but showing the wing-nerve-veins distinctly in raised ridges: dorsal region roughened; abdomen regularly tapering, curiously roughened and dull, except the smooth hinder edge of each segment; cremaster thick, elongated, and very blunt, semi-divided by a deep dorsal longitudinal suture, tipped with minute curled bristles. Colour pale brown, rather darker on the back, but with a white stripe along the back of each wing-case. Occasionally it also is found of a bright green colour with white markings.

On, or under, a leaf of beech, placed upon a silken carpet to which the cremaster is attached, and held in its place by a silken thread across the back.

The winter is passed in this condition.

The moth sits during the day, occasionally upon the trunks of beech-trees, very much more frequently among the leaves in the low thick branches, from which it is easily disturbed, but not necessarily so easily captured, since it often flits away into some higher portion of the tree. At dusk it flies about the trees, and it does not often come under the notice of the eager collector at that time. Formerly it was to be found, occasionally, in the London suburbs, but apparently has quite forsaken them. Almost confined to beech woods, and in them often abundant, in Kent, Sussex, Surrey, Hants, Wilts, Berks, Oxfordshire, Bucks, and Essex; scarce in Dorset and Devon, and also in Norfolk, Suffolk, and Cambridgeshire; found locally in Gloucestershire, Herefordshire, Worcestershire, Cheshire, Lancashire, and Yorkshire; and it has been taken once in Durham, and once in Northumberland. I am not aware of its occurrence elsewhere in the United Kingdom. Abroad it is found throughout Central Europe, Northern Italy, Corsica, Livonia, and Southern Russia.

In the *Entomologists' Intelligencer* for 1860 is an account by Mr. H. T. Stainton of a hybrid between this species and

*E. orbicularia*, which was reared by Mr. Henry Cooke, of Brighton. It appears that Mr. Cooke confined together several such ill-assorted couples, and that in one instance they paired, the female being of the present species; she laid only eight eggs, and they all hatched; some of the larvæ closely resembled that of one parent, some of the other, and some were intermediate; all fed up and went into pupa; but one moth only emerged, and that a little crippled. It bore no resemblance to *E. trilinearia*, indeed was far more like *E. punctaria* and *E. porata* than either of its parents.

4. **E. omicronaria**, *Schiff.*; **annulata**, *Staud. Cat.*—Expanse 1 inch. All the wings pale yellow, with a central smoky-brown ring followed by a stripe of lace-work, formed of lines beautifully looped and rippled.

Antennæ of the male pectinated for rather more than one-half their length with short ciliated teeth, remaining portion simple, yellowish-white; palpi very slender, horizontal, yellow-brown; eyes black; face convex, silky yellowish-white; head whiter; thorax and abdomen smooth, slender, whitish-yellow; anal tuft somewhat conical. Fore wings rather narrow, costa flatly arched; apex angulated; hind margin very gently and evenly curved; dorsal margin a little rounded, very strongly ciliated; colour pale yellow, or whitish-yellow, palest along the costal region; first line rather far from the base, slender, and formed into large curves, black; second line also black, disposed throughout in deep scallops and long angular points, and closely preceded by a cloudy black line or stripe which evidently represents the central shade, but is actually only a cloudy black backing to the scallops of the second line, throwing them into apparent loops; discal spot a black ring having a white centre; a faint cloudy brown stripe, not always visible, seems to indicate the subterminal line; extreme hind margin edged with black streaks; cilia yellowish-white. Hind wings rather squared at the apex and anal angle, from both the hind margin is

almost straight to a blunt flat angle in its middle; colour pale yellow, paler towards the costa; near the base is a smoky-black transverse line formed into two curves; in the middle an ovate central spot, in the form of a black compressed ring filled in with white; near this is some blackish dusting towards the dorsal margin; beyond is an irregular black transverse line of scallops and pointed angles, dusted inwardly with black; between this and the hind margin is a more regular curved stripe of cloudy-black dusting, sometimes very faint; hind margin edged with a thin black line, or series of black-brown streaks; cilia yellowish-white. Female extremely similar, but with simple antennæ.

Underside of all the wings yellowish-white; fore wings tinged with yellow on the costa and hind margin; second line partly visible as a rippled blackish stripe from the costa; other markings only perceptible as shades from the upper side. Body and legs yellowish-white.

Generally not very variable, but liable to interesting and very persistent local strains of variation. In Kent, in the Dover district, Mr. Sydney Webb finds a race in which the smoky-black central stripe which forms the backing to the beautiful loops of the second line, is very much intensified, sometimes broadened, in other cases of a deeper black; in some individuals this darkening process is extended so that in one of Mr. Webb's specimens the base and dorsal margins of all the wings are blackened, there is a black stripe along the subcostal nervure of the fore wings and a very broad black transverse band, which on the hind wings is less black but almost equally broad and followed by a black submarginal stripe. Another specimen has the outer half of all the wings occupied by much paler smoky-black bands; and these are connected with the typical form by all intermediates. Another local race has appeared in Devonshire, where, in the year 1868, the Rev. J. Hellins reared, from larvæ obtained by Mr. D'Orville, in both emergences, specimens devoid of the ring-spots of both fore and hind wings. More recently



Dr. Riding has obtained, in successive years in the same district, many specimens in which this discal spot is absent from the fore wings, and a few in which, as in Mr. Hellins' specimens, it is obsolete also in the hind.

On the wing in May and the beginning of June; and as a partial second generation sometimes as early as the end of June, but usually at the end of July and in August.

LARVA cylindrical and of almost uniform bulk throughout, the ninth, tenth, and eleventh segments very slightly broader than the remainder; head broader than the second segment, with the lobes rounded and the face flat, chocolate-brown with paler markings; skin smooth; segmental divisions well defined; ground colour clear velvety dark green; dorsal line yellow, commencing on the head, and conspicuous through the dorsal area; subdorsal lines waved, also yellow, as are the subdorsal region and the segmental divisions; spiracles and raised dots distinct, black; ventral surface pale green, with small black tubercles, segmental divisions black. (G. T. Porritt.)

A variety figured by Mr. Buckler has the ground colour pale brown, with similar markings; he, moreover, figured his green larva with a *green* head. It is certainly known that this species, like many others, is dimorphic in the larva state, the alternative colours, as in several other species, being green and brown.

June and sometimes the beginning of July, and as a partial second generation at the end of August and in September; on maple (*Acer campestre*) and as a substitute, in confinement, on sycamore; but I find no evidence of its occurrence upon sycamore in a natural state. There is some reason to suppose that it may occasionally feed on hornbeam.

PUPA very like that of a little butterfly; sharply squared in front, with a projecting point at each shoulder; the front portion rather flattened; gently tapering throughout to the anal tip; limb and antenna-covers shining, sharply defined

by intermediate longitudinal channels; wing-covers minutely covered with cross-wrinkling, but having the nervures very strongly and prominently marked, dull green with a smoky black stripe down the back of each wing-cover; dorsal and abdominal segments very dull from abundance of minute wrinkling and pitting, except the smooth hind-band of each segment; dull green with two central and two lateral rows of brown spots down the whole length of the back; cremaster a thick blunt knob, having at its tip several minute hooked bristles; dull pale brown. On the underside of a leaf, upon a thin carpet of silk in which the anal bristles are tightly twisted; held in place by a fine silken thread across the back.

Professor Poulton in the course of his experiments noticed that the brown variety of the larva in every case produced a pupa of which the ground colour was also brown.

In this condition through the winter.

The moth is a quiet insect of gentle flight, hiding through the day in maple bushes, under the leaves, in hedges, lanes, or woods, and if disturbed flying only a very short distance to hide again. At dusk it flies of its own accord, and at night will come to light. Its favourite haunts are the maple bushes growing in beech woods on the chalk hills, but it is by no means uncommon, as already remarked, in lanes and hedges. Mr. Herbert Goss assures me that in the valleys of the Cotswold Hills it is plentiful among hornbeam (*Carpinus betulus*). Formerly it occurred at Dulwich, and in other parts of the suburbs of London; but has long been expelled; still it is to be found commonly in suitable places in Kent, Sussex, Surrey, Hants—in plenty in the New Forest—locally in Dorset, Devon, Somerset, Wilts, Berks, Oxfordshire, Bucks, Gloucestershire, Herefordshire, Worcestershire, Northamptonshire, Cambridgeshire, Essex, Suffolk, and Norfolk; also in Yorkshire, where it is far from rare; but beyond this I find no records in these Islands. Abroad it seems to be

common over the greater part of Central Europe. Middle and Northern Italy, Dalmatia, Southern Russia, and Bithynia.

5. **E. orbicularia**, *Hüb.*.—Expanse 1 to 1½ inch. Wings soft dull pale slate-grey, dusted with red and dark grey; on each wing is a central red, purple-red, or red-black ring with a white centre, and beyond it rippled red-grey transverse lines.

Antennæ of the male pectinated, for two-thirds of their length, with solid ciliated teeth, thence simple, whitish-grey; palpi smooth, dark brown; tongue long and slender; eyes golden-brown; face convex, shining, deep dark brown; top of the head and the thorax slightly roughened with raised scales, pale slate-grey, mixed with purple-red; abdomen smooth, pale grey, barred and mottled with black; lateral tufts spreading; anal tuft conical. Fore wings not broad; costa decidedly arched; apex angulated; hind margin immediately below it very faintly hollowed, rather curved, or bent, in the middle, more obliquely curved towards the anal angle; dorsal margin straight, strongly ciliated; colour pale grey much dusted with dark grey and clouded with purple-red; first line only visible as a series of purplish-black streaks or nervures, and second line as an oblique curved row of obscure black dots; discal spot a distinct purple-red ring; immediately outside it is a gracefully curved and scalloped purple-red central stripe throwing off points outwardly on all the nervures; immediately beyond the second line is a partial row of red or red-black cloudy spots; extreme hind margin dotted or streaked with black; cilia purplish-grey. Hind wings rather rounded at the apex and anal angle, faintly crenulated behind and having a very blunt angle in the hind margin; colour as in the fore wings, and the dorsal half of the middle of the wings much clouded with purple-red; central spot a red-black ring with a white centre; near the base is a transverse line of red-black spots or streaks, and beyond the middle a more complete line of the same colour, dotted or irregularly angulated, and excessively

jagged, but often obscured by black dusting; extreme hind margin dotted with black; cilia pale grey. Female quite similar, but with simple antennæ.

Underside of all the wings pale silvery grey, abundantly dusted with dark grey; the lines of the upper side represented by rows of streaks upon nervures. Body grey; legs pale dull brown.

A little variable in the degree of grey or blackish dusting and red clouding, and in the distinctness of the lines and central rings, but with few or no noticeable local forms. An abnormal specimen in the collection of Mr. S. J. Capper has one wing only—the left fore wing—elongated, and its markings so altered that outside the second line the space is filled with black streaks running along nervures almost to the hind margin, and between them blotched with grey and purple-red; the other three wings are normal.

On the wing in May, and the beginning of June, and as a partial second generation in July and the beginning of August.

LARVA cylindrical and of nearly uniform width throughout, but the front, and also the last three segments, slightly narrower than the rest; head a little notched on the crown, the lobes rounded, of the same width as the second segment but narrower than the third, pale brown, prettily reticulated and spotted with dark brown, but two stripes of the paler brown colour, running through each lobe, are very conspicuous; ground colour of the dorsal surface bright apple-green; a pale greyish line, finely edged with dark green, forms the dorsal stripe; the subdorsal lines are of the same colour, but waved throughout their entire length; the whole of the spiracular region, including the space between the subdorsal and ventral regions, is in some specimens entirely white, but in others is very delicately and beautifully marked, at regular intervals, throughout the entire length, with blotches of pink or bright pale purple; on each side of the fifth to

the ninth segments, there is an oblique smoky mark, each mark commencing on the front of the segment, and extending backwards into the pale spiracular area; the usual dots and spiracles are distinct, black; ventral surface green with fine longitudinal white stripes; prolegs tipped with pink. (G. T. Porritt.)

The Rev. J. Greene, says—Head reddish-brown; back olive-green, gradually shading off towards the sides to a delicate pink or salmon-colour; a series of oblique lateral stripes of a dark brown, generally six in number, becoming indistinct toward the anal extremity, which is itself purplish bordered with salmon-colour; body and legs minutely punctured with olive-green dots.

Both these forms are figured by Mr. Buckler, and also one in which for the green is substituted pale brown.

A very timid larva, usually resting by day in a twisted position, but at the slightest touch falling and hanging suspended by a thread.

June, and a second generation in July or August, or even September; on willow and alder. Its time of feeding, however, varies according to the season; if this is hot the larvæ of the first brood feed up in three weeks, and within another fortnight eggs are again laid; the resulting larvæ usually feed slowly—between two and three months—but occasionally a part, or all of them, go rapidly through their changes, and a third generation of larvæ is feeding in September. In the warm climate of Bournemouth, Mr. Percy M. Bright has, in one year, reared *three* complete generations, and a portion of a fourth.

In one of his interesting papers on the colours of larvæ, Professor Poulton says that the larva of this species is dark coloured when young, and very early takes a position when at rest in which it exactly resembles the excrement of a snail; the body is twisted into a very irregular spiral, and the illusion is all the more complete because, at this stage, it gnaws the leaf from the surface only, and does not eat from

the edge, so that the chief strands of the fibro-vascular framework are left exactly as they are when a snail has been at work. He goes on to say that when it becomes larger it presents, when at rest, a striking resemblance to the excrement of a bird; it is still dark-coloured, but possesses a series of markings along the sides which are shown irregularly in the twists and curves of the attitude assumed. His full remarks upon this and the allied species, which are of great interest, may be found in the Proceedings of the Entomological Society of London for 1884.

PUPA most curiously truncate in front, exactly as though sharply and squarely cut off, the shoulders of the wings sharply angled at the same level; limb and antenna-covers closely compacted, minutely roughened or granulated, and the latter showing, indistinctly, traces of the pectinations; wing-covers glistening from minute cross-sculpture on the shining surface, through which the nervures stand out in ridges; dorsal surface dull with abundant fine granulations; two black dots close to the dorsal line at the back of the head, and two more, distinct but wide apart, half-way down the thoracic portion; remainder dusted with black, the general colour being either pale brown or green; abdominal segments regularly tapering but elongated, minutely pitted, but glossy and scarcely roughened; cremaster thick, but hollowed beneath, long and blunt, terminated by a bunch of minute hooked bristles; brown. Attached, like those of the other species, to a silken film or carpet, by these bristles and a silken thread drawn across the back.

The moth is to be obtained occasionally, though rarely, by beating hedges at the outsides of woods, or the undergrowth within, but is usually scarce in the perfect state. It flies at dusk, but is hardly ever taken at that time, or at night unless attracted by a strong light. The very large majority of specimens in collections have been reared in confinement, and most of them from the egg; indeed, scarce



as is the moth it is very easily reared, and but for parasitic foes would doubtless be plentiful. Yet it may be more frequent and more widely distributed than we are aware of, being certainly of somewhat secret habits. We know it to occur in Kent, Sussex, and Surrey; rather commonly in the New Forest, Hants; also in Dorset, in Worcestershire, and rarely in Suffolk; but a considerably wider range is probable. In Wales I once took a specimen on a wooded heath in Pembrokeshire, and Mr. Vivian has found it in Glamorganshire. So far as I know this is the extent of its range in these Islands, since Mr. W. Reid's capture of several specimens, in his own garden at Pitcaple, near Aberdeen, seems to point to escape of larvæ from captivity, rather than to the natural occurrence of this species in so unlikely a spot.

Abroad it is found throughout Central Europe, Northern Italy, Finland, and Southern Russia.

6. *E. pendularia*, L.—Expanse 1 to 1½ inch. All the wings white, dusted with purple-grey; each with two dotted transverse lines, and between them a red-black ring, centred with white.

Antennæ of the male pectinated with rather long slender ciliated teeth to two-thirds of their length, thence simple, whitish-brown; palpi small, curved, pale brown; tongue rather long; eyes bronzy-brown; face convex, smooth, orange-brown; top of the head white; thorax and abdomen smooth brownish-white; anal tufts narrow. Fore wings rather elongated; costa arched; apex angulated; hind margin faintly retuse, and then gently and evenly rounded; dorsal margin rather full and strongly ciliated; white, faintly dusted with purplish-grey, and sometimes a little with purplish-red; first line erect, a little curved, usually consisting of dots on the nervures, reddish-black toward the costa, more red below; second line distinct, placed rather far back, and formed of a curved oblique row of cloudy-black or red-black

dots; discal spot a conspicuous purple-red ring enclosing a white spot; just outside it is a curved oblique central shade of grey or purple-grey dusting; subterminal line faintly indicated by small grey clouds scattered along the hind marginal space; hind margin dotted with black; cilia white. Hind wings rounded behind and having scarcely any indication of an angle in the middle, but the anal angle squared; white, dusted and shaded with grey or purple-grey; near the base is a short transverse line, often consisting only of three or four black dots on the nervures, and following directly from the first line of the fore wings; second line continued in the same manner as a waved and curved line of similar dots with cloudy connections; central spot a distinct black ring with a white centre; touching this is a transverse shade of grey atoms; usually a more complete stripe of similar clouds of grey atoms lies along the hind marginal region, the extreme edge of which is dotted with black; cilia white. Female extremely similar, but with simple antennae.

Underside of the fore wings white, abundantly dusted with smoky-brown, excessively so towards the base; hind wings only very slightly dusted; the second line conspicuously rippled and dotted, and continuous on all the wings. Body greyish-white; legs pale brown.

Variable in the degree of dusting or clouding with grey or purple-grey, the second generation being especially liable to an increase of this, and even at times suffused or blotched with reddish-grey. Specimens from Folkestone, in the collection of Mr. F. J. Hanbury, have beautiful dark purple blotches along the hind margins. In a specimen from the collection of the late Mr. F. Bond, now in that of Mr. Sydney Webb, the whole surface of both fore and hind wings is smooth dark greyish-purple, except the transverse lines and central spots, which are white; in another the whole surface is suffused with grey, except the middle area of the fore wings, which is strongly tinged with purple-red; in a third, of similar colouring and suffusion, but less dark, the first and

second lines, and the continued lines of the hind wings, are all altered into series of short black streaks upon nervures; and a fourth has the fore wings tinged with pale *yellow*. Irish specimens are rather often found to be richly clouded with purplish-pink; Mr. J. J. F. X. King has one taken at Killucan, West Meath, beautifully ornamented with a broad ill-defined band of this colour; and Mr. B. A. Bower has one somewhat similar. Finally, Dr. P. B. Mason possesses a specimen in which the usual black dots, which edge the hind margins of all the wings, are altered into short black lines, running inward, and producing a striking effect.

On the wing in May and June, and as a very partial second generation in August.

LARVA elongate, slightly thickened behind; head large, hardly bifid; bright red-brown; face pinkish-brown with two white spots at the top; general colour bright yellowish-green; undersurface paler; dorsal, subdorsal, and spiracular lines yellowish, very faint and threadlike; divisions of the segments yellow; prolegs bright red-brown or purple-brown: anal extremity, and also the anterior feet, similar; on the undersurface is a faintly paler ventral stripe. (C. Fenn.)

Or—Ground colour pinkish-purple, or greyish-purple; head dark sienna-brown, the mouth and a line down each side of the median suture dull ochreous-yellow; throughout the dorsal area extends a broad pale smoky band, having through its centre the pale grey dorsal line: bordering this band, on each side, are the interrupted, indistinct, similarly coloured subdorsal lines; there are no perceptible spiracular lines, but that region is variegated with conspicuous pale grey marks; on the front of the fifth to the ninth segments is, on each, a conspicuous brick-red transverse mark; spiracles and raised dots distinct, black; ventral surface dull smoke-colour with an interrupted grey central stripe; legs pale yellowish-brown, barred with black; prolegs pinkish-purple. (G. T. Porritt.)

Among the examples figured by Mr. Buckler is this second form, and a modification thereof; also the light brown equivalent for the first variety above described, but unfortunately no green form—which it must be concluded had not come under his notice.

Professor Poulton says that when this larva is half grown it is brown in colour, and that it then, when at rest, hangs very often from the edge or underside of a leaf, the body being thrown into a spiral of one to one and a half turns, the head downwards, and the whole appearance that of a brown spiral larva-case hanging from a leaf. This twisted form he found to be assumed not only while the larva rested during the day, but also during the long period of quiescence preceding a change of skin.

End of June and July, and as a partial second generation in August and September; on birch, and occasionally on alder and oak; feeding principally at night.

PUPA very like that of a butterfly; truncate at the head which is the broadest portion; tapering regularly to the anal segment; at each shoulder is a sharp point; colour yellowish-white, dusted with grey; eye-covers a little prominent and connected by a raised ridge; limb-covers closely compacted, all glossy and smooth; antenna-cases cross-ribbed; wing-covers rather flattened or hollowed, the nervures forming longitudinal ridges, dull yet hardly sculptured, but a little wrinkled; along the back of each is a conspicuous black-brown stripe; dorsal region very dull with minute roughnesses, dotted with brown in four irregular lines, which are continued down the back of the abdomen, and supplemented by others along the line of the spiracles; down the front of the abdomen is a broad purplish-brown stripe, and the surface is dotted with minute sculpture rather wrinkled than pitted; the smooth hinder bands being paler and rather broad; cremaster broad, conical, ridged above and beneath, and very blunt, terminated by a minute bunch of curved bristles.

Like its congeners, placed under a leaf upon a thin silken carpet, to which the bristles of the cremaster are tightly fixed, also supported by a silken thread across the back.

The moth sits during the day under leaves in birch bushes or the lower branches of birch trees, and is readily disturbed by the beating stick, when it flies vigorously away to a similar shelter. Its natural flight is at dusk, and it has been known to come to the blossoms of heather in the autumn; and also to be occasionally attracted by light. It formerly occurred in the South London suburbs, but seems to have been driven further out. Its usual haunts are open woods and woody heaths where birch bushes are plentiful, and in such situations it is common in the Southern Counties of England, and more locally so in the Eastern and Western Counties. In the Midland districts it is usually absent, but has been found in Sherwood Forest, Notts, in the Burnt Wood, Staffordshire, and in Warwickshire. Further north it is very local in Yorkshire and Cumberland, and there is one doubtful record in Northumberland. In Scotland it exists in the district of the Solway, in Ayrshire, Argyleshire, Kincardineshire, Aberdeenshire, Moray, and Ross-shire, and is rather frequent at Moncrieffe Hill and elsewhere in Perthshire. In Wales I find but one record—in Glamorganshire—though it surely cannot be absent elsewhere. In Ireland it is local, but sometimes common in Wicklow, Kerry, Galway, Westmeath, and Tyrone. Abroad found throughout Central Europe, the temperate portions of Northern Europe, Northern Italy, Southern and Eastern Russia, and Eastern Siberia.

## Genus 2. **HYRIA.**

Antennæ of the male simple but thickly bristly; palpi minute; head smooth, transversely divided; thorax very slender and small, the shoulder-lappets elongated and raised;

abdomen smooth and slender; fore wings narrow, much rounded at the apex; hind wings short, the hind margin somewhat squared.

We have but one species.

1. **H. auroraria**, *Gn. muricata*, *Staud. Cat.*—Expanse  $\frac{3}{4}$  inch. Dull crimson, or purple-crimson, fore wings clouded, and hind wings spotted, with yellow; cilia broadly yellow.

Antennæ of the male rather short, not pectinated, but set with double rows of fine bristles, shining white; palpi minute, black-brown; eyes black; face convex, purple-brown; top of the head white; front portion of the thorax deep purple, hinder part yellow; abdomen small and slender, smooth, dull purple, the segments very narrowly edged with yellow; anal tuft compressed, yellow. Fore wings rather ovate; costa gently arched at the base and toward the tip, the middle portion straight; apex decidedly rounded; hind margin also rounded; dorsal margin a little filled out and strongly ciliated; colour crimson-purple, or dull crimson, usually with a large cloudy yellow patch from the base, occupying the dorsal half of the wing to the middle, and there expanding broadly toward the costa, sometimes divided by a curved "first line" of the ground colour, and again by a longitudinal dash of the same, into three portions, bounded outwardly by the second line, which is purple-black and sinuous; a diffused shade of purple-black atoms runs along the subcostal nervure; hind margin and cilia broadly rich deep yellow. Hind wings short and small, almost rounded behind, but having an indication of a very blunt angle in the middle of the hind margin; dull crimson with a yellow central spot surrounded by fainter yellow clouding; beyond this in the crimson area is a faint ill-defined blackish-purple stripe; hind margin and cilia broadly rich yellow. Female very similar, rather more purple; antennæ devoid of the bristles.

Undersides of all the wings similar to the upper except



that the crimson-purple becomes dark purple, and the yellow paler. Body and legs dusky yellow; hinder pair of legs short.

Very variable in the degree of yellow clouding. In the South-east of England this is sometimes so much extended, upon the fore wings, as to confine the crimson-purple colour to the costal and hind marginal regions; and Dr. P. B. Mason possesses a specimen of which the wings are wholly yellow except the blackish-purple outer line on all the wings. On the other hand specimens from the mosses of the North and North-west of England are almost devoid of the yellow clouding, the whole surface of the fore and hind wings being dull crimson-purple, except the discal and central spots, which are now visible as yellow dots, and the cilia, which remain narrowly yellow. There is some intermediate variation, especially in specimens from the bogs of the New Forest, but the general tendency is very strongly to these local strains.

On the wing at the end of June and in July. In confinement very casual specimens of a partial second generation have been reared in October.

LARVA three-fourths of an inch long, slender, rather flattened along the spiracles, tapering towards the head, which is small, bifid, light brown; the skin a little wrinkled, either brown or very pale grey; anterior and posterior segments much tinged with ochreous; a blackish double dorsal line commences very fine and faint on the second segment, but on segments five to nine becomes suddenly thicker in the middle of each and at the segmental fold, so as to form a series of nine pairs of dark curved dashes, alternately curving inwards and outwards; on segments ten to twelve these dorsal lines become continuous again, but strong and distinct; the subdorsal line is blackish and distinct on the front and hind segments, but splits into two or three faint irregular threads on the intermediate portion; spiracles

black; undersurface darker than the back, with a pale central line, and between it and the spiracles some curved oblique dark streaks; also a row of fine black dots just below the spiracles on segments five to nine; ventral and anal prolegs tinged with blue. One larva had also a strong black spiracular stripe beginning at the fourth segment, and ending at the anal pair of prolegs.

When young dusky brown, with the anterior segments pale ochreous on the back, and the middle segments having pale diamond marks enclosing a central dusky spot; but that of the northern variety at this time was very dark brown, almost black, all over; but with a lens a slightly paler subdorsal line can be discovered, as well as some black central dorsal spots placed in a slightly paler space. (Rev. J. Hellins.)

August till May or June; on *Polygonum aviculare* (knotgrass), and other low-growing plants. So far as I can ascertain the actual ordinary food-plant of this species is not known; doubtless it is some plant which grows especially in wet boggy places, for which, in confinement, knotgrass serves, as in so very many species of Geometridæ, as a substitute.

PUPA slender, cylindrical, very smooth, with the wing-cases short and distinctly marked; colour dull pale ochreous; wings finely outlined in black. In a mere apology for a cocoon—a few bits of moss and grass, just drawn together with the greatest economy of silk, between which the pupa can be distinctly seen. (Rev. J. Hellins.)

The moth sits during the day in the wettest spots, close to, or upon, the ground, in boggy places, and is not easy to disturb, though it may now and then be trodden up in the warm sunshine. It flies naturally at dusk, and far more freely at about four o'clock in the morning, soon after which it hides itself. There is a record of its being seen to fly swiftly by day in the New Forest, close over the tops of long

grass, but this must have occurred in exceptional weather. It certainly will come occasionally to a strong light at night in the fens. It frequents fens, wet bogs, and mosses, and in them is very local, never apparently flying far from the very limited, favourite spot. In such places it has been found near Deal and elsewhere in Kent; in Tilgate Forest, Sussex; in Surrey, very rarely near Brookwood, and formerly near Croydon; still found in some plenty in certain spots in the New Forest, Hants; at Bloxworth, and formerly at Great Horton, Dorset; rarely in Somerset and Gloucestershire, and at Ross, Herefordshire; in Wicken Fen, Cambs.; formerly at Whittlesea Mere and Yaxley Fen, and in Holme, Burwell, and Bottisham Fens; still at Tuddenham, Suffolk; plentifully at Ranworth, Horning, and in many other spots in the fens of Norfolk; and commonly in the extensive "mosses" of Cheshire, Lancashire, Yorkshire, Westmoreland, and Cumberland. So far as I can discover, it has not been noticed in Wales or Scotland. In Ireland the late Mr. E. Birchall found it on boggy heaths in the South-west of Ireland, but it does not seem to have been noticed there since his time. Abroad it is found throughout Central Europe, Middle and Northern Italy, Corsica, Finland, Dalmatia, Tartary, and, in the more purple-crimson form, in Japan.

## ADDITIONS AND CORRECTIONS.

Vol. iv., p. 355.—**Xylophasia lateritia**, Hufn. A single specimen of this species, not previously known as British, was taken on the coast of Glamorganshire, South Wales, by Mr. W. E. R. Allen, Llandaff, about the year 1887; but being mistaken for a variety of *Aplecta adreana*, which it somewhat resembles, was then overlooked. It has now been brought under notice by Mr. H. W. Vivian. It is of the size of *X. lithoxygla*; of coarse, dull texture of fore wings, which are red-brown or liver-coloured, very uniform, the only markings being a distinct yellow clondy spot edged behind with black, in the place of the reniform stigma; a series of obscure black dots representing the second line: and some pale yellow dots on the costa. Hind wings smoky whitish-brown. It is a species well known in Central Europe and many parts of Northern Europe, and apparently not an unlikely insect to occur with us. Should it establish its claim to rank as a British species its natural place would seem to be between *X. polyodon* and *X. rurea*.

Vol. vi. Plate 254. I am informed by Mr. E. Wheeler, from whose exquisite drawings the figures of moth's eggs in this work were derived, that the two figures on this plate have been transposed; that the figure 1a therein is that of the egg of *Calocula flavina*, and figure 2 that of *C. sponsa*.

Vol. vi., p. 72.—**Cucullia lychnitis**. The pupa of this species has been most kindly sent me for description by Mr. Percy C. Reid. It is rather short and thick, the tongue-case very stout, rounded, and so much elongated as to reach quite to the anal segment; wing-covers also thick, semi-transparent; the limb-cases so closely compacted that this

portion of the pupa is quite smoothly cylindrical and even. its colour pale soft brown, totally without sculpture; dorsal and abdominal segments equally smooth, devoid of pitting or sculpture, yet well divided, looking as though turned out of smooth grain-less brown wood, their margins a little more red-brown; spiracles large, narrowly horse-shoe shaped, dark brown; cremaster blunt, rather flattened, rounded behind and quite devoid of bristles or spikes.

Present vol., p. 94.—**Selenia illunaria**. Mr. W. Evans of Edinburgh draws attention to a circumstance which I had overlooked; that in Scotland a single generation only of this species is known—emerging in May. He assures me that he has never seen a Scotch specimen of the smaller, summer, form = *juliaria*, Haw.

P. 255.—**Psodos coracina**. Mr. Percy C. Reid now writes as follows: “I am sending you a pupa. I obtained it at Rannoch. The local collectors know it well, and rear numbers every *second* year, for it is usually common in the *odd* years (1899, 1901, &c.). It is obtained by turning back the moss and lichens, especially round the edges of the small bare patches that exist at the proper elevation, or along the edges of a footpath or sheep track, or round the sides of rocks and stones. There is no cocoon; the pupa is found on the surface of the earth, or sometimes partially buried.”

This is a very curious pupa.—Rather stout, thickest across the shoulders; brilliantly glossy; wing and limb-covers all a little swollen, very smooth and almost devoid of wrinkling or sculpture, semitransparent, pale yellowish-green, shading at the ends of the wing-covers into pale olive-brown; head smooth and glossy, pale brown; thoracic shield pale green: dorsal and abdominal segments also extremely glossy, devoid of pitting or sculpture, yellow-brown, but with the hind band of each red-brown; anal segment rather bulbous; cremaster pale brown, very short and thick, rounded behind and furnished with a few very short fine bristles, but with-

out hooks or spikes; spiracles distinct, black. I know of no pupa more smoothly glossy. Strange to say, the larva does not seem to have been noticed, except when laid-up and about to change to the pupa; Mr. P. C. Reid says that its food must be either bearberry (*Arctostaphylos uva-ursi*), crowberry (*Empetrum nigrum*), lichens or heather, and he inclines to the first named.



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antumnaria . . . . .	56	vernaria . . . . .	285	plumaria . . . . .	31
erosaria . . . . .	67	Ligdia . . . . .	270	Strenia . . . . .	4
fuscantaria . . . . .	63	adustata . . . . .	270	clathrata . . . . .	4
Ephyra . . . . .	304	Lomaspilis . . . . .	274	Tephrosia . . . . .	174
omicronaria . . . . .	316	marginata . . . . .	274	biundularia . . . . .	178
orbicularia . . . . .	320	Metrocampta . . . . .	111	consonaria . . . . .	174
pendularia . . . . .	324	margaritata . . . . .	111	extersaria . . . . .	186
porata . . . . .	304	(Mniophila) . . . . .	157	punctularia . . . . .	189



# PLATE CCLXXXI.

FIG. 1. *Strenia clathrata*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var.
1 <i>c</i> .	„	„	„ „ Surrey.
1 <i>d</i> .	„	„	„ „ Dr. P. B. Mason.
1 <i>e</i> .	„	„	„ „ Mr. S. Webb.
1 <i>f</i> .	„	„	„ „ „ „
1 <i>g</i> .	„	„	„ „ Mr. S. J. Capper.
1 <i>h</i> .	„	„	„ „ „ „
1 <i>i</i> .	„	„	„ „ „ „
1 <i>j</i> .	„	„	larva, Mr. W. Buckler.



1



1'



1<sup>b</sup>



1<sup>c</sup>



1<sup>d</sup>



1<sup>e</sup>



1<sup>f</sup>



1<sup>g</sup>



1<sup>j</sup>



1<sup>h</sup>



1<sup>i</sup>

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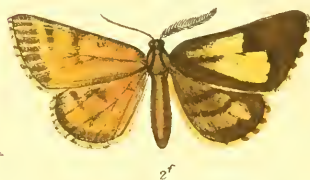
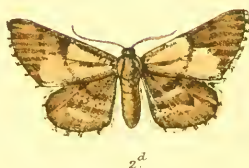
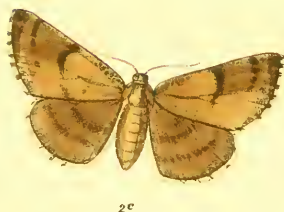
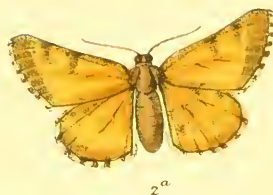
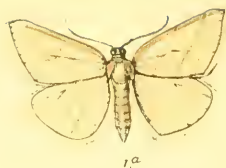
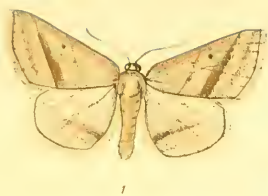




## PLATE CCLXXXII.

FIG. 1. *Panagra petraria*.

- |              |                           |       |                                      |
|--------------|---------------------------|-------|--------------------------------------|
| 1 <i>a</i> . | „                         | „     | var. Ranworth Fen.                   |
| 1 <i>b</i> . | „                         | „     | larva, Mr. W. Buckler.               |
| 2.           | <i>Fidonia piniaria</i> . | male, | South of England.                    |
| 2 <i>a</i> . | „                         | „     | female „ „                           |
| 2 <i>b</i> . | „                         | „     | male, Midlands.                      |
| 2 <i>c</i> . | „                         | „     | female „                             |
| 2 <i>d</i> . | „                         | „     | „ „                                  |
| 2 <i>e</i> . | „                         | „     | male, var. Mr. W. P. Blackburn-Maze. |
| 2 <i>f</i> . | „                         | „     | gynandro „ „                         |
| 2 <i>g</i> . | „                         | „     | larva, Mr. W. Buckler.               |







# PLATE CCLXXXIII.

FIG. 1. *Fidonia atomaria*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var. Mr. S. Webb.
1 <i>c</i> .	„	„	„ „ „ „
1 <i>d</i> .	„	„	„ „ „ „
1 <i>e</i> .	„	„	„ Dr. P. B. Mason.
1 <i>f</i> .	„	„	female, Mr. S. Webb.
1 <i>g</i> .	„	„	„ „ „
1 <i>h</i> .	„	„	male „ „
1 <i>i</i> .	„	„	gynandro „ „
1 <i>j</i> .	„	„	larva, Mr. W. Buckler.



1



1a



1b



1c



1d



1j



1f



1g



1e



1h



1i

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## PLATE CCLXXXIV.

FIG. 1. *Fidonia pinetaria*, male.

1*a.*     ,,             ,,       female.

1*b.*     ,,             ,,       larva, Mr. W. Buckler.

2.       ,,       *conspicuata*, male.

2*a.*     ,,             ,,       female.

2*b.*     ,,             ,,       larva, Mr. W. Buckler.

3.       ,,       *carbonaria*, male.

3*a.*     ,,             ,,       female.



1



7a



7b



2



2a



2b



3



3a







# PLATE CCLXXXV.

- FIG. 1. *Fidonia conspicuata*, male, var. Mr. Sydney Webb.  
 2.       ,,       *carbonaria*, var. Mr. S. J. Capper.  
 3. *Scodionæ belgiaria*, male.  
 3*a.*       ,,       ,,       female.  
 3*b.*       ,,       ,,       male, var. Mr. S. J. Capper  
 3*c.*       ,,       ,,       ,,       ,,       Mr. S. Webb.  
 3*d.*       ,,       ,,       female ,,       ,,       ,,  
 3*e.*       ,,       ,,       male   ,,       Yorks, Mr. G. T. Porritt.  
 3*f.*       ,,       ,,       female ,,       ,,       ,,       ,,  
 3*g.*       ,,       ,,       larva, Mr. W. Buckler.



1



2



3



3<sup>a</sup>



3<sup>b</sup>



3<sup>c</sup>



3<sup>d</sup>



3<sup>e</sup>



3<sup>f</sup>



3<sup>g</sup>





## PLATE CCLXXXVI.

FIG. 1. *Numeria pulveraria*, male.

1*a.*     ..             „       female.

1*b.*     ..             „       larva, Mr. W. Buckler.

2. *Selidosema plumaria*, male.

2*a.*     ..             ..       „       var. New Forest.

2*b.*     ..             ..       „       „       North Ireland.

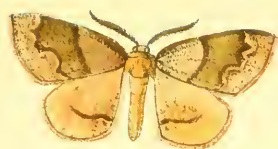
2*c.*     ..             „       female       „       „

2*d.*     ..             „       larva, Mr. W. Buckler.

3. *Scoria dealbata*, male.

3*a.*     ..             ..       female.

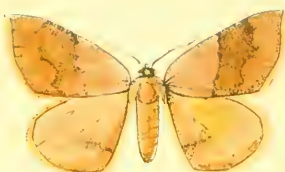
3*b.*     ..             ..       larva, Mr. W. Buckler.



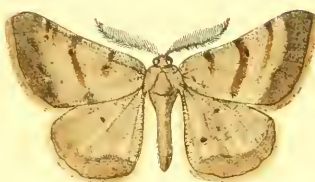
1.



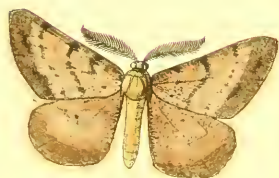
1b.



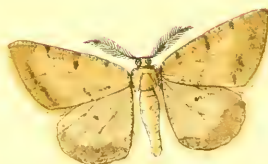
1a.



2.



2a.



2b.



3a.



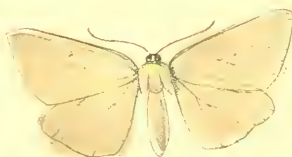
2c.



2d.



3.



3a.







## PLATE CCLXXXVII.

FIG. 1. *Aspilates strigillaria*, male.

- |              |    |    |                         |                   |
|--------------|----|----|-------------------------|-------------------|
| 1 <i>a</i> . | ,, | ,, | female.                 |                   |
| 1 <i>b</i> . | ,, | ,, | male, var. Mr. S. Webb. |                   |
| 1 <i>c</i> . | ,, | ,, | female ,,               | ,,                |
| 1 <i>d</i> . | ,, | ,, | ,,                      | ,, Lancashire.    |
| 1 <i>e</i> . | ,, | ,, | ,,                      | ,,                |
|              |    |    |                         | Mr. S. J. Capper. |
| 1 <i>f</i> . | ,, | ,, | larva, Mr. W. Buckler.  |                   |
| 2.           | ,, |    | <i>gilvaria</i> , male. |                   |
| 2 <i>a</i> . | ,, | ,, | female.                 |                   |
| 2 <i>b</i> . | ,, | ,, | male, var. Mr. S. Webb. |                   |
| 2 <i>c</i> . | ,, | ,, | female ,,               | ,,                |
| 2 <i>d</i> . | ,, | ,, | larva, Mr. W. Buckler.  |                   |



1



1<sup>a</sup>



1<sup>b</sup>



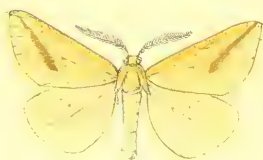
1<sup>c</sup>



1<sup>e</sup>



1<sup>d</sup>



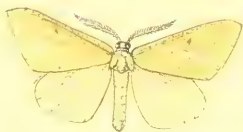
2



1<sup>f</sup>



2<sup>a</sup>



2<sup>b</sup>



2<sup>d</sup>



2<sup>c</sup>



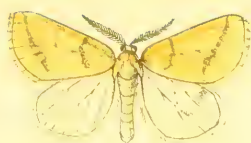




## PLATE CCLXXXVIII.

FIG. 1. *Aspilates citraria*, male.

- |             |   |   |                        |
|-------------|---|---|------------------------|
| 1 <i>a.</i> | „ | „ | female.                |
| 1 <i>b.</i> | „ | „ | male, var.             |
| 1 <i>c.</i> | „ | „ | „ „ Mr. S. Webb.       |
| 1 <i>d.</i> | „ | „ | female „ „ „           |
| 1 <i>e.</i> | „ | „ | larva, Mr. W. Buckler. |
2. *Eurymene dolobraria*, male.
- |             |   |   |                        |
|-------------|---|---|------------------------|
| 2 <i>a.</i> | „ | „ | female.                |
| 2 <i>b.</i> | „ | „ | larva, Mr. W. Buckler. |



1.



1<sup>a</sup>



1<sup>b</sup>



1<sup>c</sup>



1<sup>d</sup>



2<sup>b</sup>



2<sup>c</sup>



2.



2<sup>a</sup>

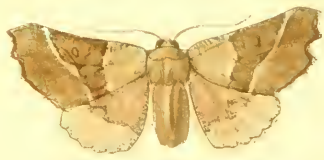
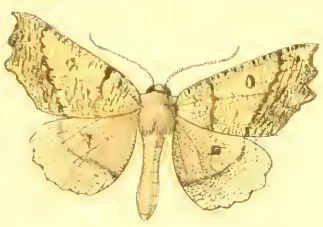
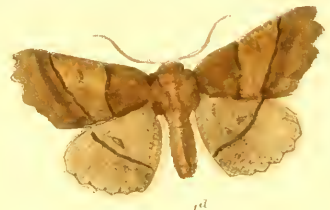
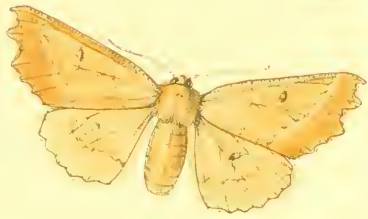
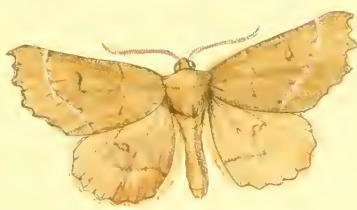
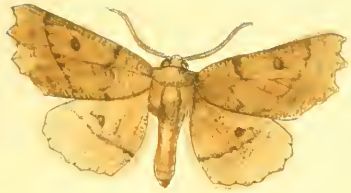




## PLATE CCLXXXIX.

FIG. 1. *Odontoptera bidentata*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var. Norfolk.
1 <i>c</i> .	„	„	female, var. Surrey.
1 <i>d</i> .	„	„	male, var. Moray.
1 <i>e</i> .	„	„	„ „ Mr. S. J. Capper.
1 <i>f</i> .	„	„	„ „ Yorkshire,
			Mr. G. T. Porritt.
1 <i>g</i> .	„	„	female „ „ „
1 <i>h</i> .	„	„	larva, Mr. W. Buckler.









## PLATE CCXC.

FIG. 1. *Ennomos autumnaria*, male.

1*a.*     ,,             ,,         female.

1*b.*     ,,             ,,         male, var.

1*c.*     ,,             ,,         female, var.

1*d.*     ,,             ,,         larva.

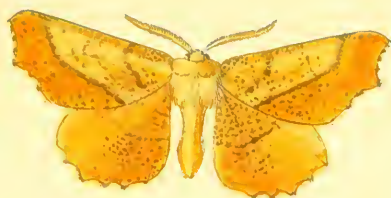
2.     ,,         alniaria, male.

2*a.*     ,,             ,,         female.

2*b.*     ,,             ,,         male, var.

2*c.*     ,,             ,,         female, var. Mr. S. Webb.

2*d.*     ,,             ,,         larva, Mr. W. Buckler.



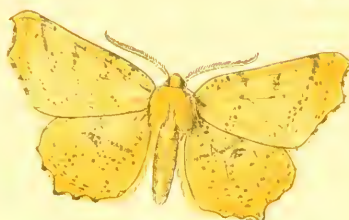
1



1a



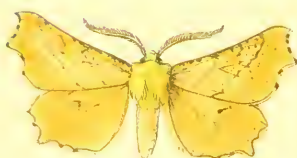
1d



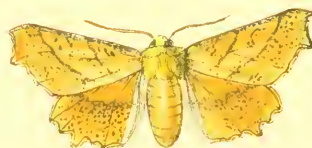
1b



1c



2



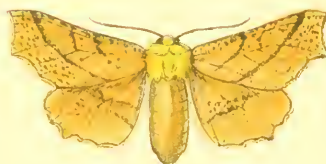
2a



2d



2b



2c



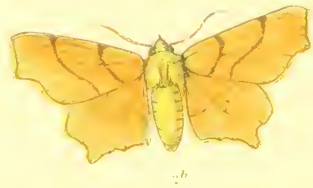
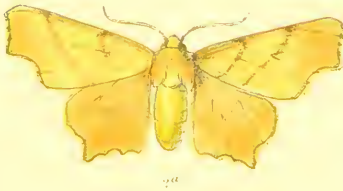
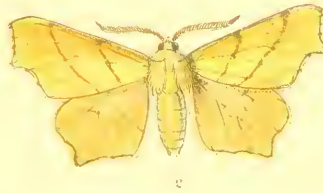
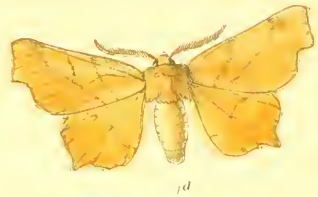
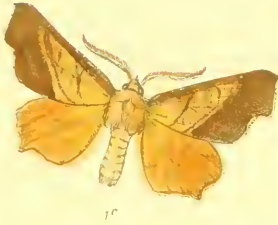
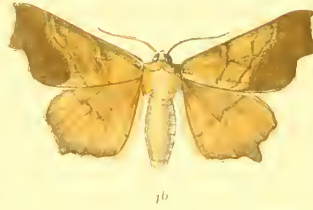
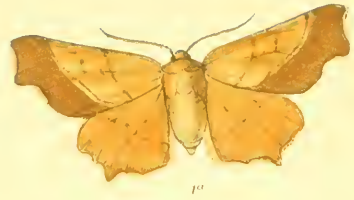
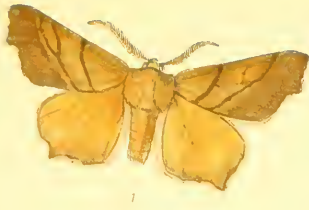




# PLATE CCXCI.

FIG. 1. *Ennomos fuscantaria*. male.

- |     |   |    |   |
|-----|---|----|---|
| 1a. | „ | .. | female.                                 |
| 1b. | „ | „  | „ var. Yorkshire,<br>Mr. G. T. Porritt. |
| 1c. | „ | „  | male „ „ „                              |
| 1d. | „ | „  | „ var. Mr. S. Webb.                     |
| 1e. | „ | „  | larva, Mr. W. Buckler.                  |
| .   | „ | „  | erosaria, male.                         |
| 2a. | „ | „  | female.                                 |
| 2b. | „ | „  | „ var.                                  |
| 2c. | „ | „  | larva, Mr W. Buckler.                   |



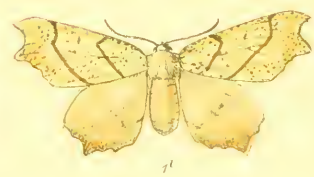
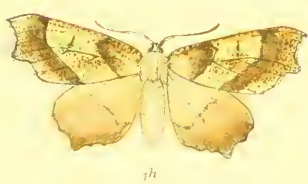
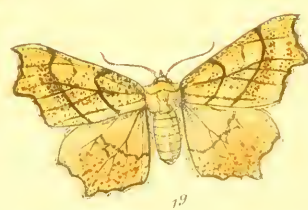
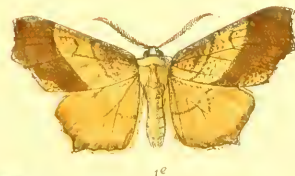
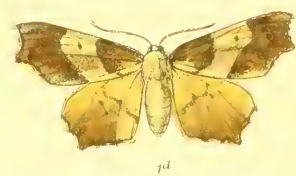
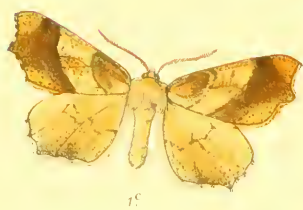
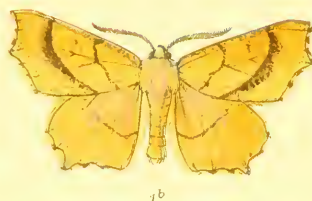
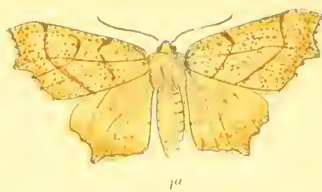




## PLATE CCXCII.

FIG. 1. *Ennomos angularia*, male.

1 <i>a.</i>	„	„	female.
1 <i>b.</i>	„	„	male, var.
1 <i>c.</i>	„	„	„ „
1 <i>d.</i>	„	„	female, var. London.
1 <i>e.</i>	„	„	male, var. Dr. P. B. Mason.
1 <i>f.</i>	„	„	„ „ Mr. S. Webb.
1 <i>g.</i>	„	„	female, var.
1 <i>h.</i>	„	„	„ „
1 <i>i.</i>	„	„	„ „
1 <i>j.</i>	„	„	larva, Mr. W. Buckler.





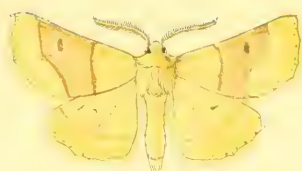




# PLATE CCXCIII.

FIG. 1. *Crocallis elinguaris*, male.

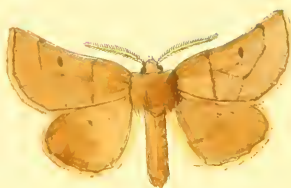
1a.	„	„	female.
1b.	„	„	male, var.
1c.	„	„	female, var.
1d.	„	„	male, var. Mr. S. J. Capper.
1e.	„	„	„ „ „ „
1f.	„	„	female, var. Mr. G. T. Porritt.
1g.	„	„	„ „ „ „
1h.	„	„	larva, Mr. W. Buckler.



L



1a



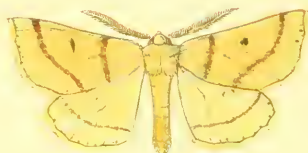
1b



1c



1e



1d



1f



1g



1h



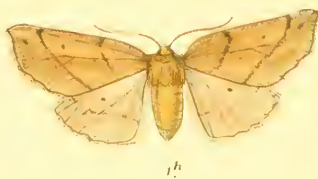
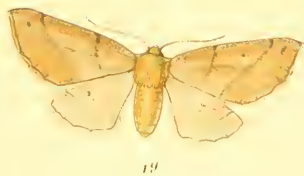
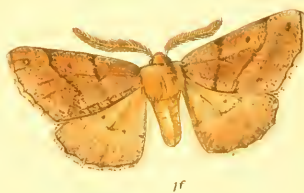
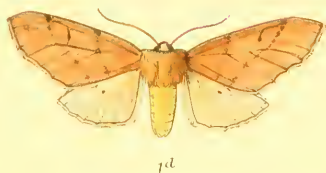
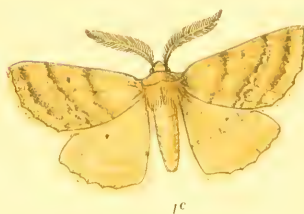
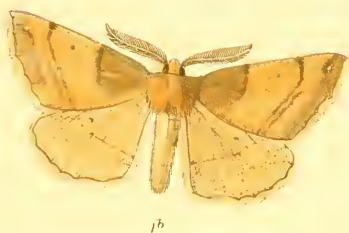
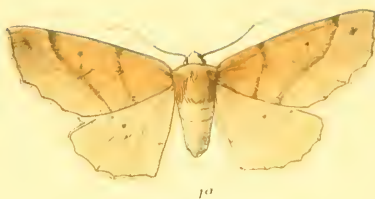




# PLATE CCXCIV.

FIG. 1. *Himera pennaria*, male.

1a.	„	„	female.
1b.	„	„	male, var. Mr. S. Webb.
1c.	„	„	„ „ „ „
1d.	„	„	female „ „ „
1e.	„	„	„ „ Dr. Mason.
1f.	„	„	male „
1g.	„	„	female „
1h.	„	„	„ „
1i.	„	„	larva, Mr. W. Buckler.



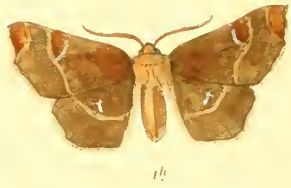
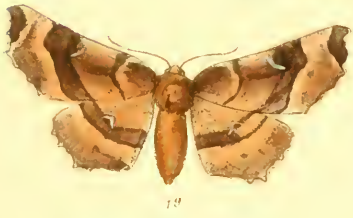
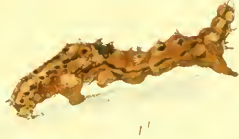
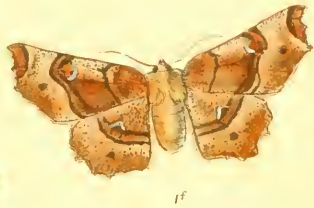
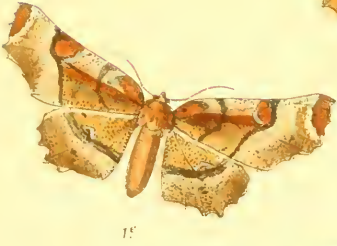
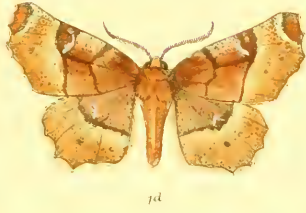
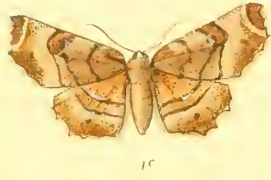
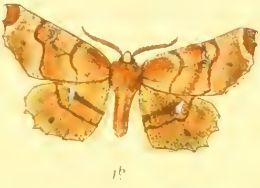




## PLATE CCXCV.

FIG. 1. *Selenia illustraria*, male.

1a.	„	„	female.
1b.	„	„	male, summer brood.
1c.	„	„	female „ „
1d.	„	„	male, var. Mr. F. Merrifield.
1e.	„	„	female „ „ „
1f.	„	„	„ „ „ „
1g.	„	„	„ „ „ „
1h.	„	„	male, var. Mr. S. Webb.
1i.	„	„	larva, Mr. W. Buckler.





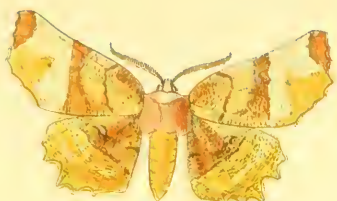




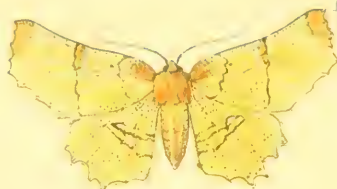
## PLATE CCXCVI.

FIG. 1. *Selenia lunaria*, male.

- |             |   |   |                          |
|-------------|---|---|--------------------------|
| 1 <i>a.</i> | „ | „ | female.                  |
| 1 <i>b.</i> | „ | „ | „ var.                   |
| 1 <i>c.</i> | „ | „ | „ „ Mr G. T. Porritt.    |
| 1 <i>d.</i> | „ | „ | larva, Mr. W. Buckler.   |
| 2.          | „ | „ | <i>illunaria</i> , male. |
| 2 <i>a.</i> | „ | „ | female.                  |
| 2 <i>b.</i> | „ | „ | male, summer brood.      |
| 2 <i>c.</i> | „ | „ | female, „ „              |
| 2 <i>d.</i> | „ | „ | larva, Mr. W. Buckler.   |



1



1<sup>a</sup>



1<sup>b</sup>



1<sup>c</sup>



2



1<sup>d</sup>



2<sup>a</sup>



2<sup>d</sup>



2<sup>b</sup>



2<sup>c</sup>







## PLATE CCXCVII.

FIG. 1. *Pericallia syringaria*, male.

1*a.*     ,,             ,,         female.

1*b.*     ..             ,,         larva, Mr. W. Buckler.

2. *Epione apiciaria*, male.

2*a.*     ..             ..         female.

2*b.*     ..             ,,         male. var.

2*c.*     ,,             ,,         ,,         ,,

2*d.*     ..             ..         ,,         ,,     Mr. S. Webb.

2*e.*     ..             ,,         female,,         ,,         ,,

2*f.*     ..             ,,         larva, Mr. W. Buckler.



1



1a



2



1b



2a



2b



2d



2e



2f



2c

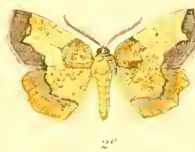
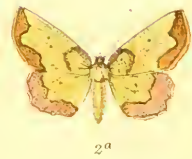
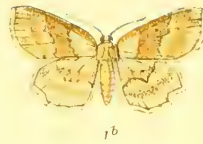




# PLATE CCXCVIII.

FIG. 1. *Epione advenaria*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var.
1 <i>c</i> .	„	„	larva, Mr. W. Buckler.
2.	„	<i>vespertina</i> , male.	
2 <i>a</i> .	„	„	female.
2 <i>b</i> .	„	„	„ var.
2 <i>c</i> .	„	„	male, var. Mr. S. Webb.
2 <i>d</i> .	„	„	„ „ „ „
2 <i>e</i> .	„	„	gynandro „ „
2 <i>f</i> .	„	„	larva, Mr. W. Buckler.









## PLATE CCXCIX.

FIG. 1. *Metrocampa margaritata*, male.

1*a.*       ,,               ,,       female.

1*b.*       ,,               ,,       larva, Mr W. Buckler.

2. *Ellopia fasciaria*, male.

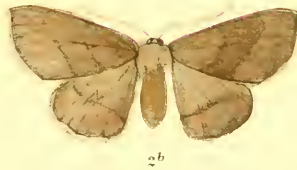
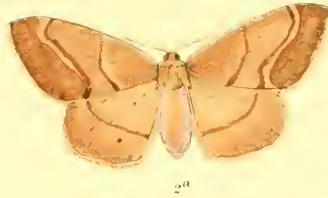
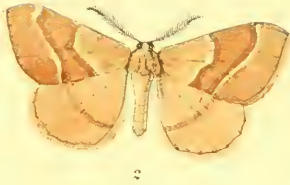
2*a.*       ,,               ,,       female.

2*b.*       ,,               ,,       var. Mr. F. C. Woodforde.

2*c.*       ,,               ,,       male,       ,, Mr. S. Webb.

2*d.*       ,,               ,,       female, var. *prasinaria*.

2*e.*       ,,               ,,       larva, Mr. W. Buckler.









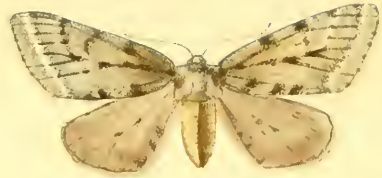
# PLATE CCC.

FIG. 1. *Biston hirtarius*, male.

- |             |    |    |                             |
|-------------|----|----|-----------------------------|
| 1 <i>a.</i> | .. | .. | female.                     |
| 1 <i>b.</i> | .. | .. | var. Mr. S. J. Capper.      |
| 1 <i>c.</i> | .. | .. | male, var. London.          |
| 1 <i>d.</i> | .. | .. | larva, Mr. W. Buckler.      |
| 2.          | .. |    | <i>prodromarius</i> , male. |
| 2 <i>a.</i> | .. | .. | female.                     |
| 2 <i>b.</i> | .. | .. | male, var. Mr. S. Webb.     |
| 2 <i>c.</i> | .. | .. | female .. ..                |
| 2 <i>d.</i> | .. | .. | .. .. Mr. G. T. Porritt.    |
| 2 <i>e.</i> | .. | .. | larva, Mr. W. Buckler.      |



1.



1a



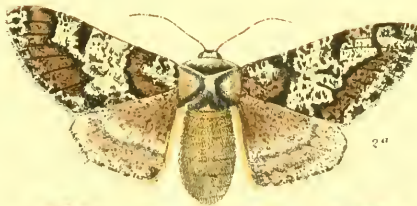
1b



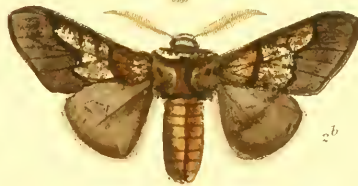
1c



2



2a



2b



3a



3b



2c



2d

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Vincent Brooks, Colver & Son, Ltd. Imp.





## PLATE CCCL.

FIG. 1. *Biston betularius*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var. Dr. Mason.
1 <i>c</i> .	„	„	female, var.
1 <i>d</i> .	„	„	male „
1 <i>e</i> .	„	„	female „
1 <i>f</i> .	„	„	male, black form.
1 <i>g</i> .	„	„	female „ „
1 <i>h</i> .	„	„	larva, Mr. W. Buckler.





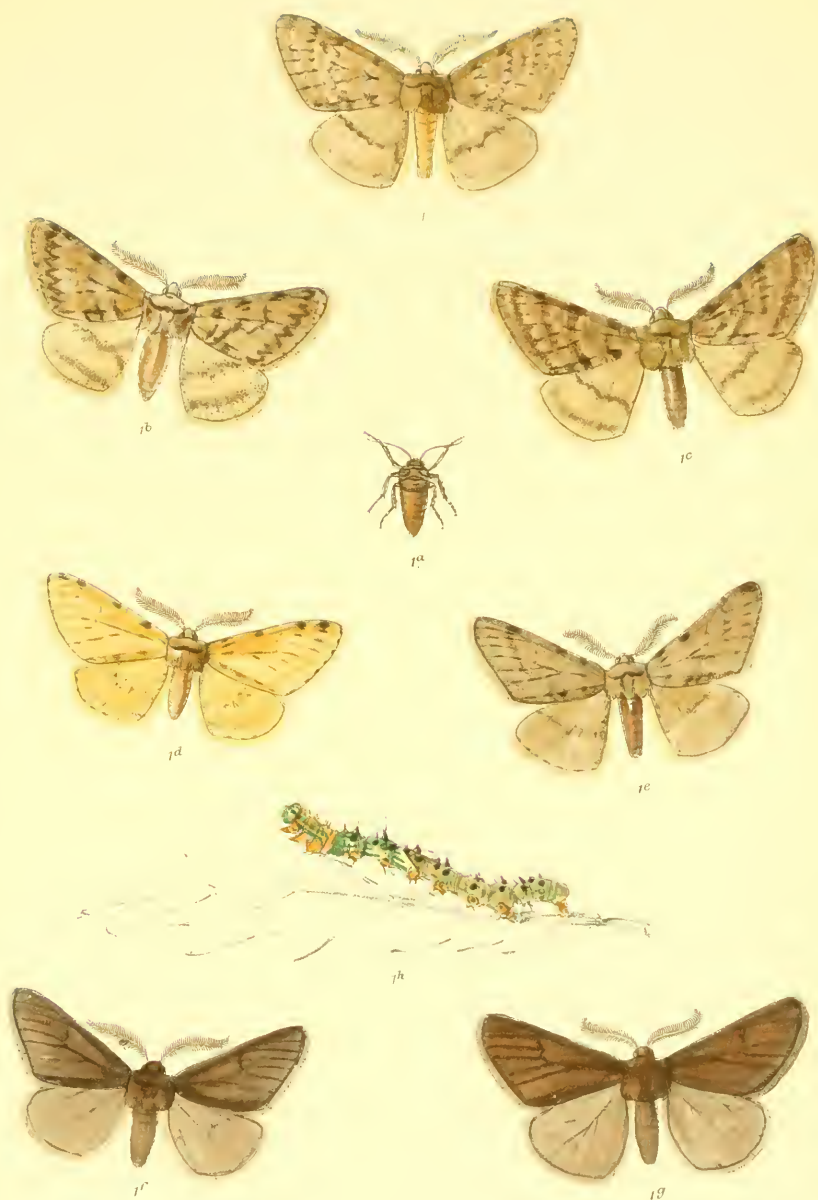




## PLATE CCCC.

FIG. 1. *Phigalia pilosaria*, male.

1 <i>a</i> .	„	„	female.	
1 <i>b</i> .	„	„	male, var.	
1 <i>c</i> .	„	„	„	„
1 <i>d</i> .	„	„	„	„ Mr. S. J. Capper.
1 <i>e</i> .	„	„	„	„ Mr. G. T. Porritt.
1 <i>f</i> .	„	„	„	„ „ „ „
1 <i>g</i> .	„	„	„	„ Dr. Mason.
1 <i>h</i> .	„	„	larva,	Mr. W. Buckler.





## ERRATUM.

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IN PART LXXVI., PLATE 303.

For Fig. *2b*, read *1e*.

„ *1e*, „ *2b*.



# PLATE CCCIII.

FIG. 1. *Nyssia hispidaria*, male.

- |              |   |             |                             |
|--------------|---|-------------|-----------------------------|
| 1 <i>a</i> . | „ | „           | female.                     |
| 1 <i>b</i> . | „ | „           | male, var. Dr. Mason.       |
| 1 <i>c</i> . | „ | „           | „ „                         |
| 1 <i>d</i> . | „ | „           | „ „                         |
| 1 <i>e</i> . | „ | „           | larva, Mr. W. Buckler.      |
| 2.           | „ | lapponaria, | male, Mr. W. M. Christy.    |
| 2 <i>a</i> . | „ | „           | female „ „                  |
| 2 <i>b</i> . | „ | „           | larva, Miss Violet Barrett. |



1



1b



1a



1c



1d



2b



2a



2



2c





# PLATE CCCIV.

FIG. 1. *Nyssia zonaria*, male.

1*a.* „ „ female.

1*b.* „ „ male, var.

1*c.* „ „ „ „

1*d.* „ „ „ „ Mr. S. Webb.

1*e.* „ „ larva, Mr. D. C. Campbell.

2. *Dasydia obfuscaria*, male.

2*a.* „ „ female.

2*b.* „ „ male, var. Dr. Mason.

2*c.* „ „ female „

2*d.* „ „ larva, Mr. W. Buckler.



1



1b



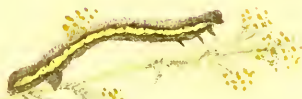
1a



1c



1d



1e



2



2a



2d



2b



2c







## PLATE CCCV.

FIG. 1. *Gnophos obscurata*, male.

1a.	„	„	female.	
1b.	„	„	male, var. New Forest.	
1c.	„	„	female, var. Kent Coast.	
1d.	„	„	„ „ „ „	Mr. Sydney Webb.
1e.	„	„	male, var. Sussex Downs.	
1f.	„	„	female „ „ „	Mr. G. T. Porritt.
1g.	„	„	male var. West of England,	Mr. Sydney Webb.
1h.	„	„	„ „ South Wales.	
1i.	„	„	female „ „ „	
1j.	„	„	„ „ Mr. S. J. Capper.	
1k.	„	„	larva, Mr. W. Buckler.	



1a



1b



1c



1d



1e



1f



1g



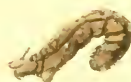
1h



1i



1j



1k



1l







## PLATE CCCVI.

FIG. 1. *Cleora lichenaria*, male.

- |             |   |            |                                      |
|-------------|---|------------|--------------------------------------|
| 1 <i>a.</i> | „ | ..         | female.                              |
| 1 <i>b.</i> | „ | ..         | larva, Mr. W. Buckler.               |
| 2.          | „ | glabraria, | male, New Forest.                    |
| 2 <i>a.</i> | „ | ..         | female „ „                           |
| 2 <i>b.</i> | „ | ..         | male, Roxburgh, N.B., Mr. A. Elliot. |
| 2 <i>c.</i> | „ | ..         | „ var. New Forest, Mr. S. J. Capper. |
| 2 <i>d.</i> | „ | ..         | female „ „ „ „ „                     |
| 2 <i>e.</i> | „ | ..         | larva, Mr. W. Buckler.               |
| 3.          | „ | viduaria,  | male, Mr. Sydney Webb.               |
| 3 <i>a.</i> | „ | ..         | female .. „ „                        |



1



1a



1b



2



2a



2b



2c



2d



2e



3



3a

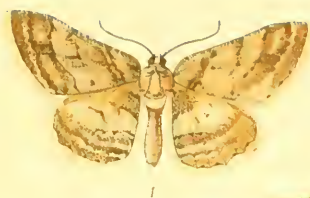




## PLATE CCCVII.

FIG. 1. *Tephrosia consonaria*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	larva, Mr. W. Buckler.
2.	„	biundularia,	male, June form.
2 <i>a</i> .	„	„	female „ „
2 <i>b</i> .	„	„	male, April form.
2 <i>c</i> .	„	„	female „ „
2 <i>d</i> .	„	„	male, var. Mr. S. Webb.
2 <i>e</i> .	„	„	female „ „ „
2 <i>f</i> .	„	„	„ „ „ „



1



1a



2



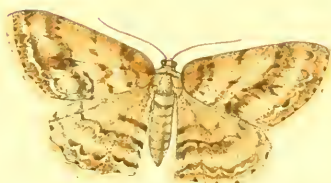
1b



2a



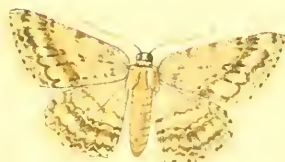
2b



2c



2d



2e



2f





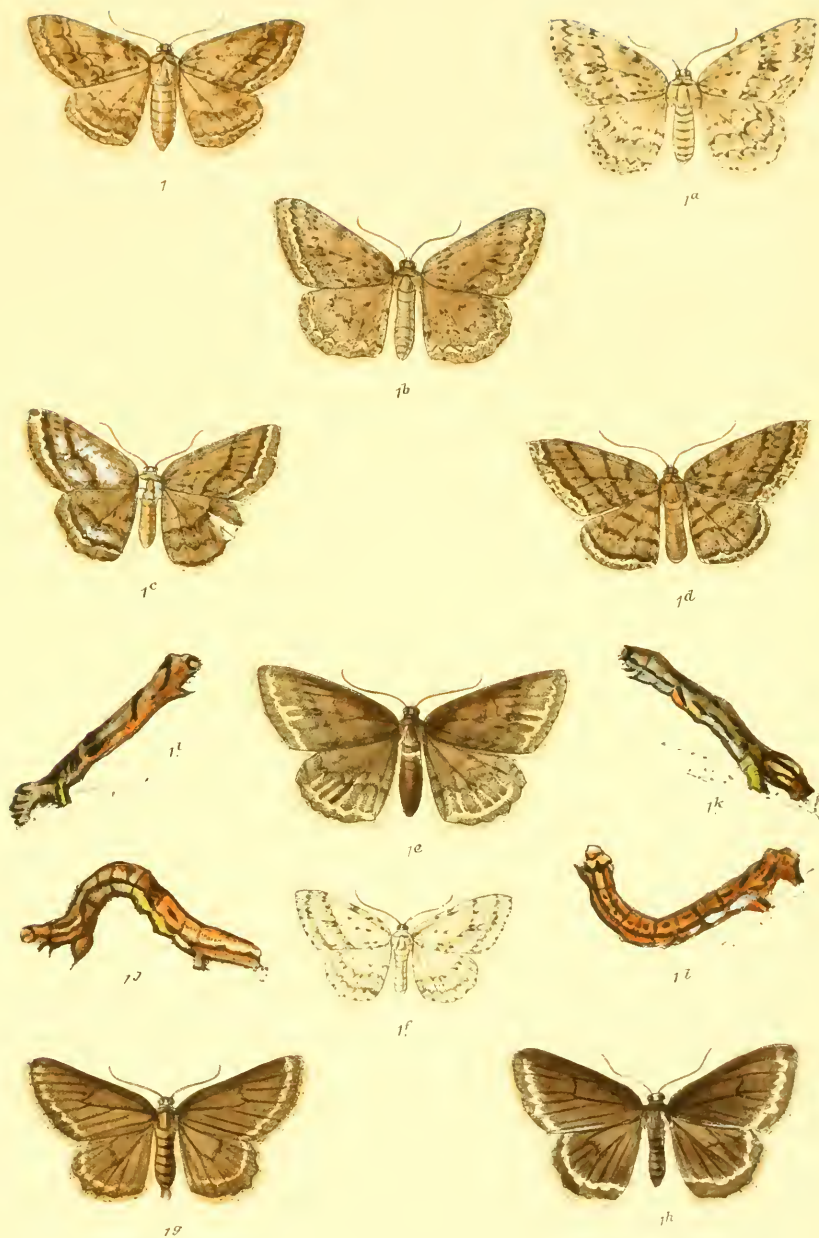


## PLATE CCCVIII.

FIG. 1. *Tephrosia biundularia*, var. Mr. Sydney Webb.

1 <i>a</i> .	„	„	var. English Midlands.
1 <i>b</i> .	„	„	„ „ „
1 <i>c</i> .	„	„	„ „ „ unsymmetrical.
1 <i>d</i> .	„	„	„ South Wales, Major Robertson.
1 <i>e</i> .	„	„	„ „ „ „
1 <i>f</i> .	„	„	second generation.
1 <i>g</i> .	„	„	black var. South Wales.
1 <i>h</i> .	„	„	„ „ „ „
1 <i>i</i> .*	„	„	larva of April race.
1 <i>j</i> .*	„	„	„ „ „
1 <i>k</i> .*	„	„	„ of June race.
1 <i>l</i> .*	„	„	„ „ „

\* Figured by Mrs. Anderson for her father, Mr. W. H. Tugwell.









## PLATE CCCIX.

FIG. 1. *Tephrosia extersaria*, male.

1*a.*        „                        „        female.

(For larva, see plate cccxiv.)

2.        „                        punctularia, male.

2*a.*        „                        „        female.

2*b.*        „                        „        male, var.

2*c.*        „                        „        „        „

2*d.*        „                        „        female „

2*e.*        „                        „        „        „        Dr. Mason.

(For larva, see plate cccxiv.)



1.



1a



2



2a



2b



2c



2d



2e

Pl. 809, an ad nat. del

Pl. 809, Brooks Day 1899, 1899

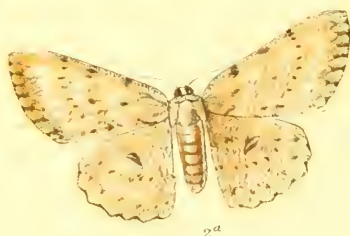
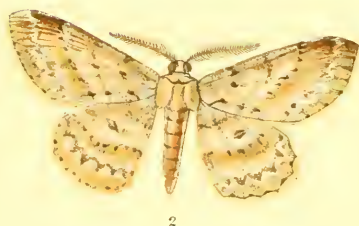
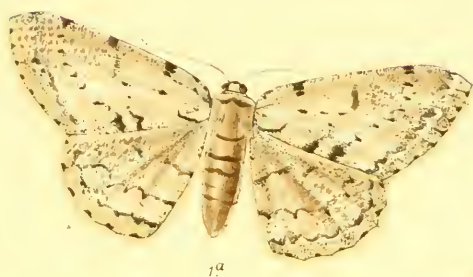




# PLATE CCCX.

FIG. 1. *Boarmia roboraria*, male.

- |              |   |                    |                                |
|--------------|---|--------------------|--------------------------------|
| 1 <i>a</i> . | „ | „                  | female.                        |
| 1 <i>b</i> . | „ | „                  | male, var. Surrey.             |
| 1 <i>c</i> . | „ | „                  | male, black, Mr. S. J. Capper. |
| 1 <i>d</i> . | „ | „                  | larva, Mr. W. Buckler.         |
| 2.           | „ | consortaria, male. |                                |
| 2 <i>a</i> . | „ | „                  | female.                        |
| 2 <i>b</i> . | „ | „                  | larva, Mr. W. Buckler.         |



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# PLATE CCCXI.

FIG. 1. *Boarmia cinctaria*, male.

1 <i>a.</i>	„	„	female.			
1 <i>b.</i>	„	„	male, var.			
1 <i>c.</i>	„	„	„	„		
1 <i>d.</i>	„	„	female	„		
1 <i>e.</i>	„	„	„	„		
1 <i>f.</i>	„	„	„	„	Mr. S. J. Capper.	
1 <i>g.</i>	„	„	„	„	„	„
1 <i>h.</i>	„	„	male	„	„	„
1 <i>i.</i>	„	„	„	black, var.	„	„
1 <i>j.</i>	„	„	„	„	„	„

(For larva, see plate cccxiv.)



1.



1<sup>a</sup>



1<sup>b</sup>



1<sup>c</sup>



1<sup>d</sup>



1<sup>e</sup>



1<sup>f</sup>



1<sup>g</sup>



1<sup>h</sup>



1<sup>i</sup>



1<sup>j</sup>

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Vincent Brookes Del. & Son Lith. Imp.





## PLATE CCCXII.

- FIG. 1. *Boarmia abietaria*, male, Mr. S. J. Capper.
- |              |    |    |                               |
|--------------|----|----|-------------------------------|
| 1 <i>a</i> . | ,, | ,, | female.                       |
| 1 <i>b</i> . | ,, | ,, | male, var. Mr. G. T. Porritt. |
| 1 <i>c</i> . | ,, | ,, | female ,, ,,                  |
| 1 <i>d</i> . | ,, | ,, | ,, ,, (intermediate).         |
| 1 <i>e</i> . | ,, | ,, | male, var. black. Surrey.     |
| 1 <i>f</i> . | ,, | ,, | female ,, ,,                  |
| 1 <i>g</i> . | ,, | ,, | larva, Mr. W. Buckler.        |



1



1a



1b



1c



1d



1e



1f

E C Knight ad nat. de.



1g

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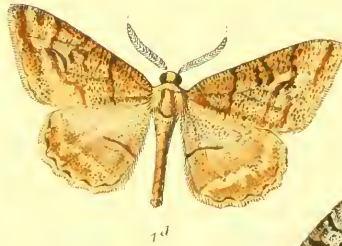
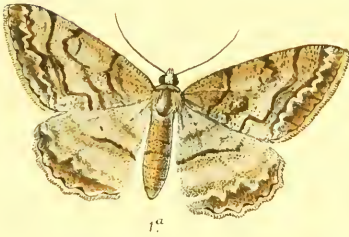
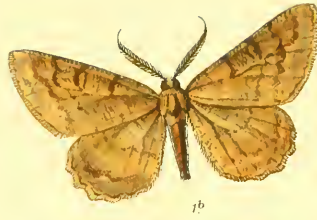
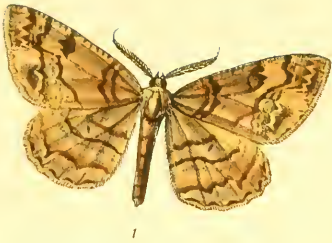




# PLATE CCCXIII.

FIG. 1. *Boarmia repandata*, male.

1 <i>a.</i>	„	„	female.			
1 <i>b.</i>	„	„	male, var.			
1 <i>c.</i>	„	„	„	„		
1 <i>d.</i>	„	„	„	„		
1 <i>e.</i>	„	„	female, var. Yorkshire.			
1 <i>f.</i>	„	„	„	„	„	Mr. G. T. Porritt.
1 <i>g.</i>	„	„	„	„	„	„
1 <i>h.</i>	„	„	„	„	„	„
1 <i>i.</i>	„	„	larva, Mr. W. Buckler.			



E.C. Knight del. et lith.

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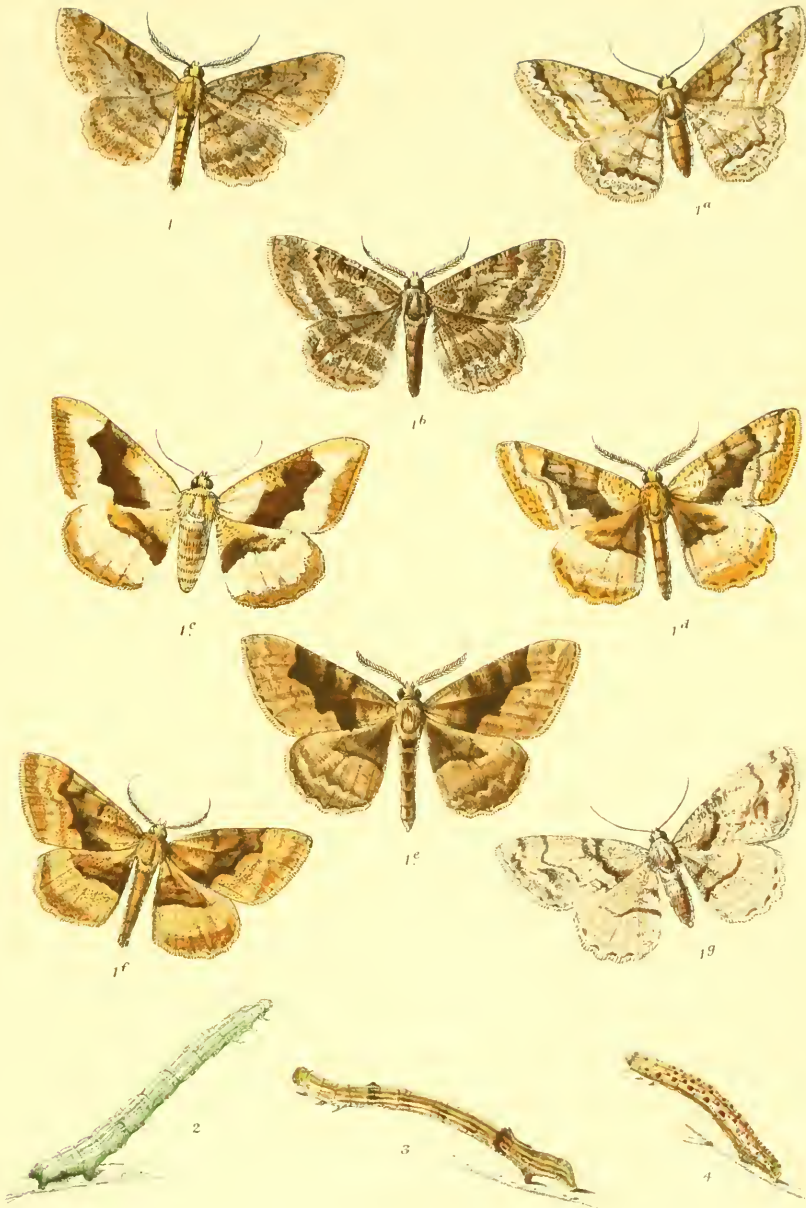


## PLATE CCCXIV.

FIG. 1. *Boarmia repandata*, male, var. Hebrides.

- |              |    |    |              |           |                   |                    |
|--------------|----|----|--------------|-----------|-------------------|--------------------|
| 1 <i>a</i> . | .. | .. | female       | ..        | ..                | Dr. Mason.         |
| 1 <i>b</i> . | .. | .. | male         | ..        | ..                | Mr. G. T. Porritt. |
| 1 <i>c</i> . | .. | .. | female, var. | Devon     | ..                | ..                 |
| 1 <i>d</i> . | .. | .. | male, var.   | Pembroke. |                   |                    |
| 1 <i>e</i> . | .. | .. | ..           | ..        | Mr. S. J. Capper. |                    |
| 1 <i>f</i> . | .. | .. | ..           | ..        | Surrey.           |                    |
| 1 <i>g</i> . | .. | .. | female, var. | Moray,    | Dr. Mason.        |                    |
2. Larva of *Boarmia cinctaria*. See plate cccxi.
3. .. .. *Tephrosia extersaria*. See plate cccix.
4. .. .. .. *punctularia*. See plate cccix.





E.C. Mugh, del et lith

Vincent Brooks, Day & Son, Lith Imp

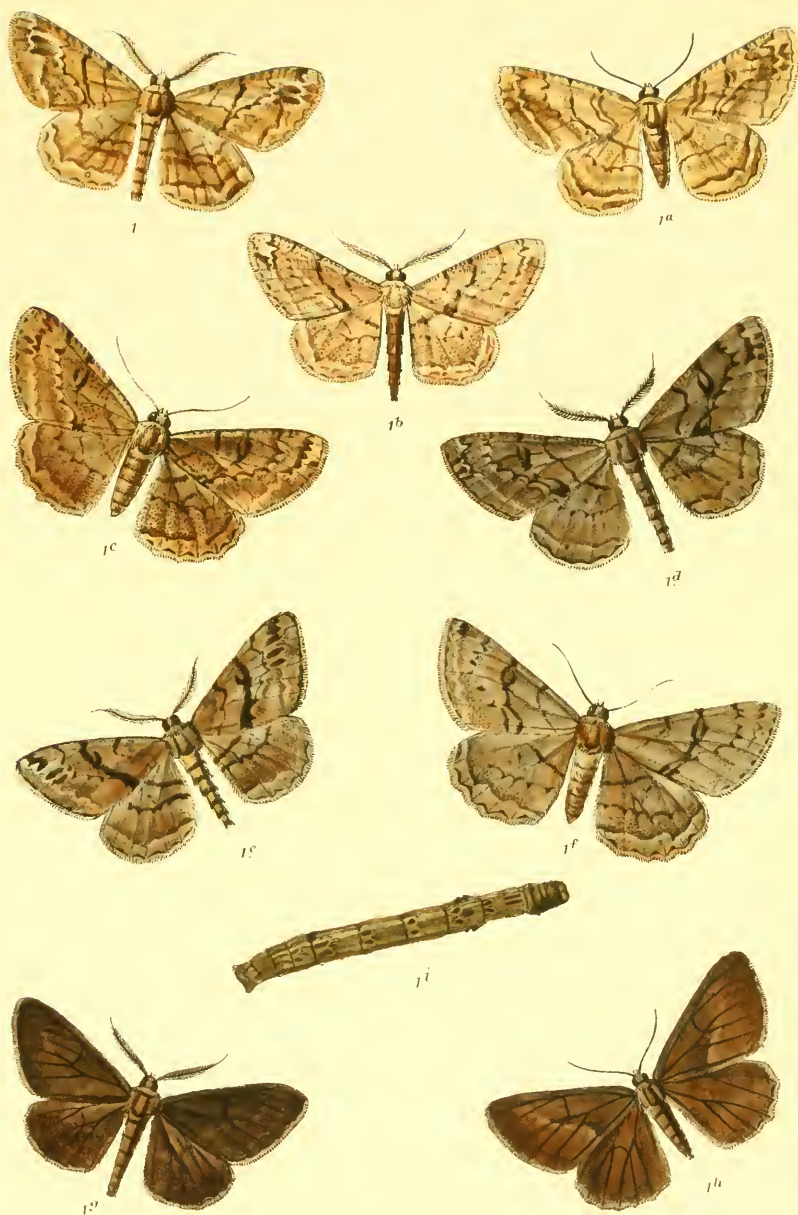




# PLATE CCCXV.

FIG. 1. *Boarmia rhomboidaria*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var. Dr. Mason.
1 <i>c</i> .	„	„	female „
1 <i>d</i> .	„	„	male, var. <i>perfumaria</i> .
1 <i>e</i> .	„	„	„ „ „ (aberration).
1 <i>f</i> .	„	„	female „ „
1 <i>g</i> .	„	„	male, var. Norwich, Messrs. Tillet.
1 <i>h</i> .	„	„	female „ „ „ „
1 <i>i</i> .	„	„	larva, Mr. W. Buckler.









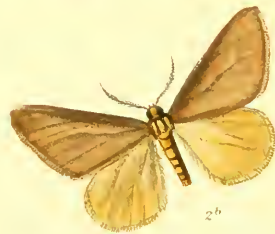
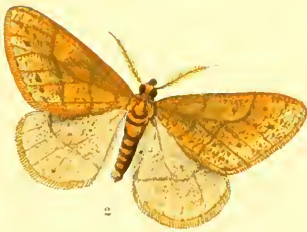
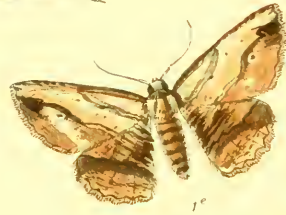
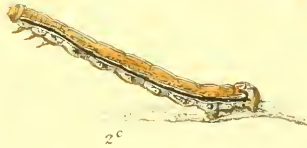
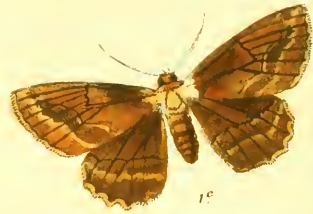
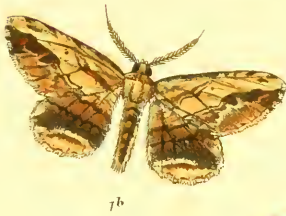
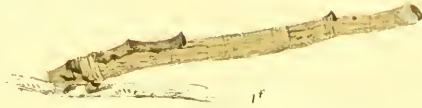
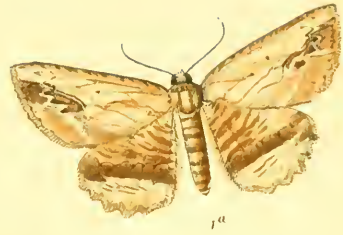
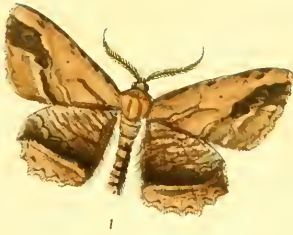
# PLATE CCCXVI.

FIG. 1. *Hemerophila abruptaria*, male.

- |             |   |   |                          |
|-------------|---|---|--------------------------|
| 1 <i>a.</i> | „ | „ | female.                  |
| 1 <i>b.</i> | „ | „ | male, var. London.       |
| 1 <i>c.</i> | „ | „ | female „ „ Dr. Mason.    |
| 1 <i>d.</i> | „ | „ | male, var. second brood. |
| 1 <i>e.</i> | „ | „ | female „ „ „ „           |
| 1 <i>f.</i> | „ | „ | larva, Mr. W. Buckler.   |

2. *Hibernia aurantiaria*, male.

- |             |   |   |                        |
|-------------|---|---|------------------------|
| 2 <i>a.</i> | „ | „ | female—sub-apterous.   |
| 2 <i>b.</i> | „ | „ | male, var. Yorkshire.  |
| 2 <i>c.</i> | „ | „ | larva, Mr. W. Buckler. |



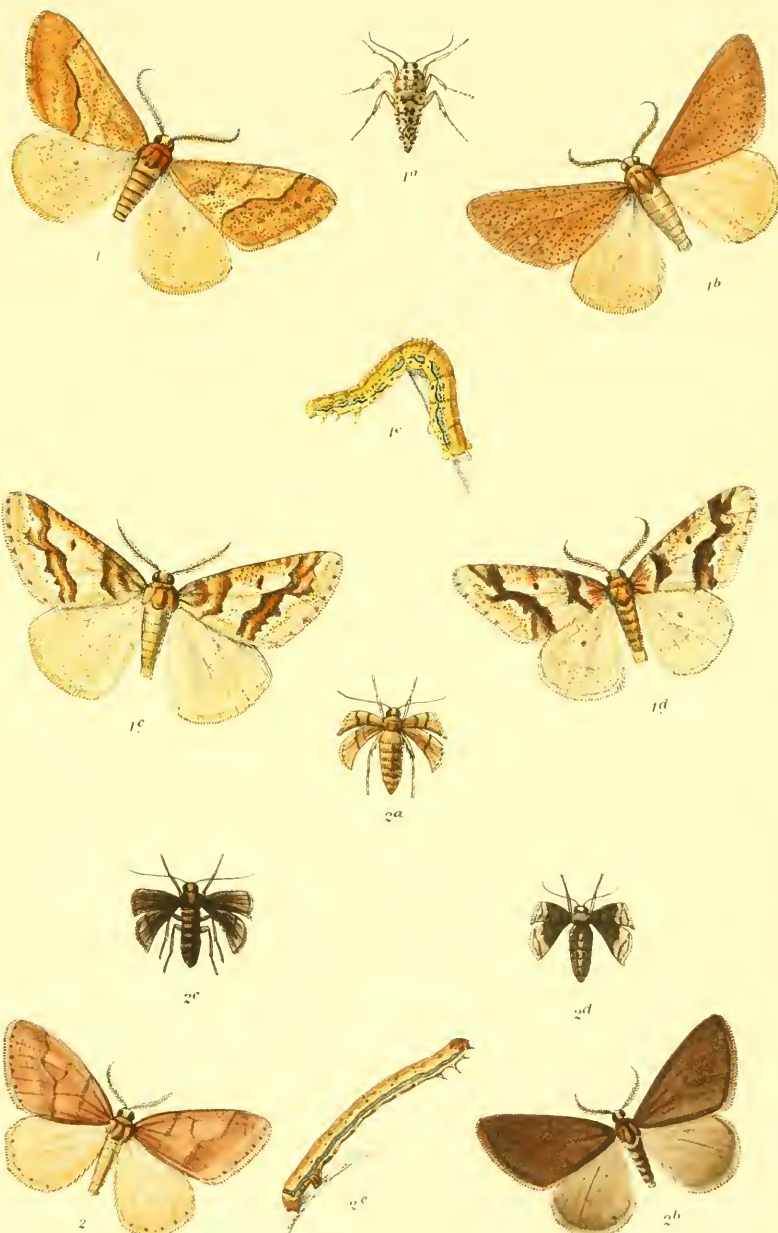




## PLATE CCCXVII.

FIG. 1. *Hibernia defoliaria*, male.

1 <i>a</i> .	„	„	female.
1 <i>b</i> .	„	„	male, var.
1 <i>c</i> .	„	„	„ „
1 <i>d</i> .	„	„	„ „
1 <i>e</i> .	„	„	larva, Mr. W. Buckler.
2.	„	progenimmaria,	male.
2 <i>a</i> .	„	„	female.
2 <i>b</i> .	„	„	male, var. Yorkshire, Mr. G. T. Porritt.
2 <i>c</i> .	„	„	female „ „ „
2 <i>d</i> .	„	„	„ „ „ „
2 <i>e</i> .	„	„	larva, Mr. W. Buckler.



E.C. Knight del., et lith.

Frederick Brooks, Day & Son, Lith.







## PLATE CCCXVIII.

FIG. 1. *Hibernia leucophæaria*, male.

- |              |    |                             |  |
|--------------|----|-----------------------------|--|
| 1 <i>a</i> . | ,, | ,,                          | female.                                  |
| 1 <i>b</i> . | ,, | ,,                          | male, var.                               |
| 1 <i>c</i> . | ,, | ,,                          | ,, ,, Pembroke-shire.                    |
| 1 <i>d</i> . | ,, | ,,                          | ,, ,, Richmond Park,<br>Mr. P. Richards. |
| 1 <i>e</i> . | ,, | ,,                          | gynandro, Dr. P. B. Mason.               |
| 1 <i>f</i> . | ,, | ,,                          | larva, Mr. W. Buckler.                   |
| 2.           | ,, | rupicaprar <i>a</i> , male. |  |
| 2 <i>a</i> . | ,, | ,,                          | female.                                  |
| 2 <i>b</i> . | ,, | ,,                          | larva, Mr. W. Buckler.                   |



1



1a



1b



1c



1e



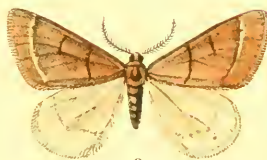
1d



2a



1f



2



2b





PLATE CCCXIX.

FIG. 1. *Anisopteryx æscularia*, male.

1*a.*       ,,               ,,       female.

1*b.*       ,,               ,,       larva, Mr. W. Buckler.

2. *Pachygnemius hippocastanaria*, male.

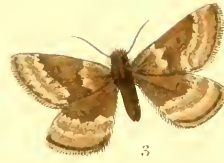
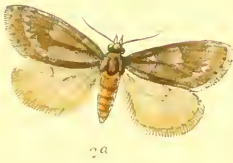
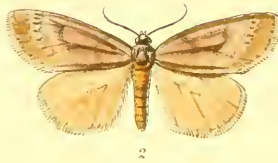
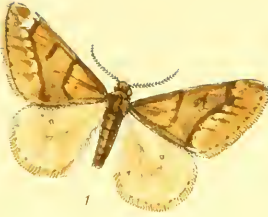
2*a.*       ,,               ,,       female.

2*b.*       ,,               ,,       larva, Mr. W. Buckler.

3. *Psodos coracina*, male.

3*a.*       ,,               ,,       female.

3*b.*       ,,               ,,       male, var.





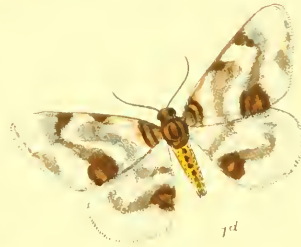
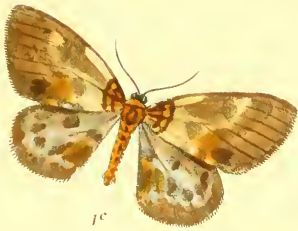
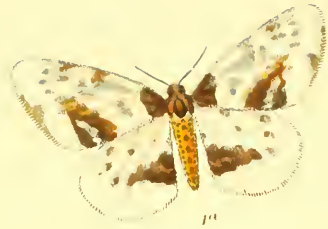




# PLATE CCCXX.

FIG. 1. *Abraxas ulmata*, male.

1 <i>a.</i>	„	„	female.
1 <i>b.</i>	„	„	var. Mr. S. J. Capper.
1 <i>c.</i>	„	„	„ Mr. Sydney Webb.
1 <i>d.</i>	„	„	„ „
1 <i>e.</i>	„	„	„ Mr. B. H. Crabtree.
1 <i>f.</i>	„	„	„ „
1 <i>g.</i>	„	„	„ Mr. G. T. Porritt.
1 <i>h.</i>	„	„	larva, Mr. W. Buckler.



E.C. Knight del. et lith.

Vincent Brooke, Fry & Son Ltd. Imp.





# PLATE CCCXXI.

FIG. 1. *Abraxas grossulariata*, male.

1 <i>a.</i>	„	„	female.	
1 <i>b.</i>	„	„	var. Mr. Sydney Webb.	
1 <i>c.</i>	„	„	„	„
1 <i>d.</i>	„	„	„	„
1 <i>e.</i>	„	„	„	„
1 <i>f.</i>	„	„	„	„
1 <i>g.</i>	„	„	„	„
1 <i>h.</i>	„	„	„	„
1 <i>i.</i>	„	„	larva, Mr. W. Buckler.	





E.C.Wright del et lith.

Vincent Brooks Day & Son Ltd Imp





# PLATE CCCXXII.

FIG. 1. *Abraxas grossulariata*, var. Mr. S. J. Capper.

1 <i>a</i> .	..	..	..	..
1 <i>b</i> .	..	..	..	..
1 <i>c</i> .	..	..	..	Mr. G. T. Porritt.
1 <i>d</i> .	..	..	..	Mr. Percy Richards.
1 <i>e</i> .	..	..	..	Mr. G. T. Porritt.
1 <i>f</i> .	..	..	..	
1 <i>g</i> .	..	..	..	
1 <i>h</i> .	..	..	..	
1 <i>i</i> .	..	..	..	



E.C.Knight del et lith

Vincent Brooks Day & Son Ltd Imp







## PLATE CCCXXIII.

FIG. 1. *Ligdia adustata*, male.

1*a*.     "            "     female.

1*b*.     "            "     larva, Mr. W. Buckler.

2.   *Lomaspilis marginata*.

2*a*.     "            "     var. Mr. S. J. Capper.

2*b*.     "            "     "     Dr. P. B. Mason.

2*c*.     "            "     "            "

2*d*.     "            "     "     Mr. G. T. Porritt.

2*e*.     "            "     "     Mr. E. A. Atmore.

2*f*.     "            "     "     Mr. Sydney Webb.

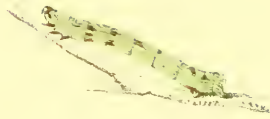
2*g*.     "            "     larva, Mr. W. Buckler.



1



1a



1b



2



2a



2b



2c



2d



2g



2f



2e

Wright de la

Vincent, Brooks, Day & Son, Ltd.





## PLATE CCCXXIV.

FIG. 1. *Pseudoterpna cytisaria*, male.

1*a.*        „        „        female.

1*b.*        „        „        larva, Mr. W. Buckler.

2. *Geometra papilionaria*, male.

2*a.*        „        „        female.

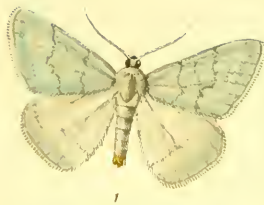
2*b.*        „        „        larva, Mr. W. Buckler.

3. *Iodis vernaria*, male.

3*a.*        „        „        female.

3*b.*        „        „        larva, Mr. W. Buckler.

PLATE 324.



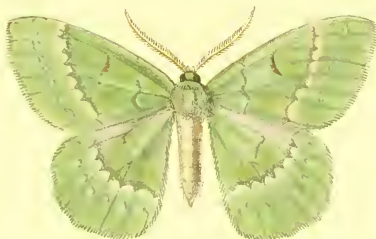
1



1<sup>b</sup>



1<sup>a</sup>



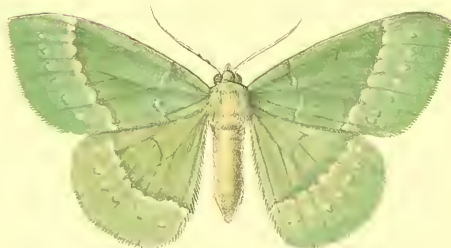
2



2<sup>b</sup>



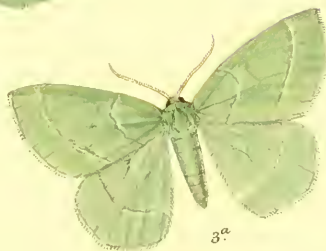
3<sup>b</sup>



2<sup>a</sup>



3



3<sup>a</sup>

E. C. Knight del, et lith.

Vincent Brooks, Day & Son Lit<sup>d</sup> Imp.







## PLATE CCCXXV

FIG. 1. *Iodis lactearia*, male.

1*a.* .. .. larva, Mr. W. Buckler.

2. *Nemoria viridata*, male.

2*a.* .. .. female.

2*b.* .. .. larva, Miss Violet Barrett.

3. *Phorodesma smaragdaria*.

3*a.* .. .. var. Mr. F. J. Hanbury.

3*b.* .. .. larva, Mr. R. Morgan  
(kindly furnished by  
Mr. H. J. Turner).

4. .. .. *bajularia*, male.

4*a.* .. .. female.

4*b.* .. .. larva, Mr. W. Buckler.

5. *Hemithea thymiaria*, male.

5*a.* .. .. female.

5*b.* .. .. larva, Mr. W. Buckler.



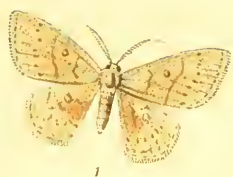




# PLATE CCCXXVI.

FIG. 1. *Ephyra porata*, male.

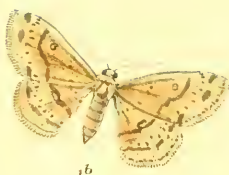
- |              |    |                  |                        |                       |
|--------------|----|------------------|------------------------|-----------------------|
| 1 <i>a</i> . | .. | ..               | ..                     | var. Mr. Sydney Webb. |
| 1 <i>b</i> . | .. | ..               | female, ..             | Mr. F. C. Woodforde.  |
| 1 <i>c</i> . | .. | ..               | ..                     | ..                    |
| 1 <i>d</i> . | .. | ..               | larva, Mr. W. Buckler. |                       |
| 2.           | .. | punctaria, male. |                        |                       |
| 2 <i>a</i> . | .. | ..               | ..                     | var. Mr. Sydney Webb. |
| 2 <i>b</i> . | .. | ..               | female, var. ..        | ..                    |
| 2 <i>c</i> . | .. | ..               | ..                     | ..                    |
| 2 <i>d</i> . | .. | ..               | ..                     | Mr. F. C. Woodforde.  |
| 2 <i>e</i> . | .. | ..               | male, ..               | ..                    |
| 2 <i>f</i> . | .. | ..               | larva, Mr. W. Buckler. |                       |



1



1<sup>a</sup>



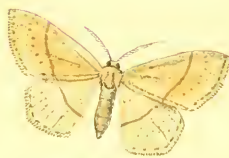
1<sup>b</sup>



1<sup>c</sup>



1<sup>d</sup>



2



2<sup>a</sup>



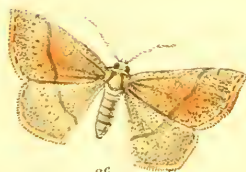
2<sup>c</sup>



2<sup>b</sup>



2<sup>e</sup>



2<sup>f</sup>



2<sup>d</sup>



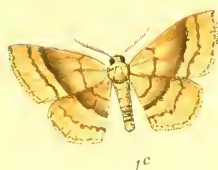
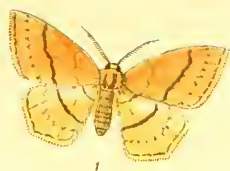




## PLATE CCCXXVII.

FIG. 1. *Ephyra trilinearia*, male.

1 <i>a</i> .	..	..	female, var. Major Ficklin.
1 <i>b</i> .	..	..	male, .. Mr. F. J. Hanbury.
1 <i>c</i> .	..	..	.. .. Mr. Sydney Webb.
1 <i>d</i> .	..	..	female .. .. ..
1 <i>e</i> .	..	..	.. .. ..
1 <i>f</i> .	..	..	larva, Mr. W. Buckler.
2.	..	..	<i>omicronaria</i> , male.
2 <i>a</i> .	..	..	.. var. Mr. Sydney Webb.
2 <i>b</i> .	..	..	female .. .. ..
2 <i>c</i> .	..	..	male .. Mr. F. C. Woodforde.
2 <i>d</i> .	..	..	larva, Mr. W. Buckler.







# PLATE CCCXXVIII.

FIG. 1. *Ephyra orbicularia*, male.

- |                                   |    |                           |                                |
|-----------------------------------|----|---------------------------|--------------------------------|
| 1a.                               | .. | ..                        | larva, Mr. W. Buckler.         |
| 2.                                | .. | <i>pendularia</i> , male. |                                |
| 2a.                               | .. | ..                        | female, var. Mr. E. A. Atmore. |
| 2b.                               | .. | ..                        | male .. Mr. F. C. Woodforde.   |
| 2c.                               | .. | ..                        | .. Mr. Sydney Webb.            |
| 2d.                               | .. | ..                        | female .., .., ..              |
| 2e.                               | .. | ..                        | larva, Mr. W. Buckler.         |
| 3. <i>Hyria auroraria</i> , male. |    |                           |                                |
| 3a.                               | .. | ..                        | .. var. Lancashire.            |
| 3b.                               | .. | ..                        | larva, Mr. W. Buckler.         |





1



1<sup>d</sup>



2



2<sup>a</sup>



2<sup>b</sup>



2<sup>c</sup>



2<sup>d</sup>



2<sup>e</sup>



3



3<sup>b</sup>



3<sup>a</sup>


















QL                    Barrett, Charles  
555                  Golding, 1836-1904.  
G7B3                The Lepidoptera of  
v.7                  the British Islands: a  
Ent.                 descriptive account of  
                      the families, genera....



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